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By Sir Oliver Lodge

Life and Matter
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Life and Matter

A Criticism of Professor Haeckel's "Riddle of the Universe"

By

Sir Oliver Lodge

G. P. Putnam's Sons
New York and London
The Knickerbocker Press

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The Knickerbocker Press, New York

"Materialistic monism is nowadays the working hypothesis of every scientific explorer in every department, whatever other beliefs or denials he may, more or less explicitly and more or less consistently, superadd. Materialistic monism only becomes false when put forward as a complete philosophy of the universe, because it leaves out of sight the conditions of human knowledge, which the special sciences may conveniently disregard, but which a candid philosophy cannot ignore."

"The legitimate materialism of the sciences simply means temporary and convenient abstraction from the cognitive conditions under which there are 'facts' or 'objects' for us at all; it is 'dogmatic materialism' which is metaphysics of the bad sort."

D. G. RITCHIE.

"Our metaphysics is really like many other sciences—only on the threshold of genuine knowledge: God knows if it will ever get further. It is not hard to see its weakness in much that it undertakes. Prejudice is often found to be the mainstay of its proofs. For this nothing is to blame but the ruling passion of those who would fain extend human knowledge. They are anxious to have a grand philosophy: but the desirable thing is, that it should also be a sound one."

KANT.

PREFACE

THIS small volume is in form controversial, but in substance it has a more ambitious aim: it is intended to formulate, or doubtless rather to reformulate, a certain doctrine concerning the nature of man and the interaction between mind and matter. Incidentally it attempts to confute two errors which are rather prevalent, viz.:

1. The notion that because material energy is constant in quantity, therefore its transformations and transferences—which admittedly constitute terrestrial activity—are insusceptible to guidance or directing control.
2. The idea that the specific guiding power which we call "life" is one of the forms of material energy; so that, directly it relinquishes its connection with matter other equivalent forms of energy must arise to replace it.

The book is specially intended to act as an antidote against the speculative and destructive portions of Professor Haeckel's interesting and widely read

work, but in other respects it may be regarded less as a hostile attack than as a supplement—an extension of the more scientific portions of that work into higher and more fruitful regions of inquiry.

OLIVER LODGE.

University of Birmingham,
October, 1905.

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LIFE AND MATTER

CHAPTER I

MONISM

IN his recent Presidential Address before the British Association, at Cambridge, Mr. Balfour rather emphasised the existence and even the desirability of a barrier between Science and Philosophy, which recent advances have tended to minimise, though never to obliterate. He appeared to hint that it is best for scientific men not to attempt to philosophise, but to restrict themselves to their own domain; though, on the other hand, he did not appear to wish similarly to limit philosophers, by recommending that they should keep themselves unacquainted with scientific facts, and ignorant of the theories which weld those facts together. Indeed, in his own person, he is an example of the opposite procedure, for he himself frequently takes

pleasure in overlooking the boundary and making a wide survey of the position on its physical side—a thing which it is surely very desirable for a philosopher to do.

But if that process be regarded as satisfactory, it is surely equally permissible for a man of science occasionally to look over into the philosophic region, and to survey the territory on that side also, so far as his means permit. And if philosophers object to this procedure, it must be because they have found by experience that men of science who have once transcended or transgressed the boundary are apt to lose all sense of reasonable constraint, and to disport themselves as if they had at length escaped into a region free from scientific trammels —a region where confident assertions might be freely made, where speculative hypothesis might rank as theory, and where verification was both unnecessary and impossible.

The most striking instance of a scientific man who on entering philosophic territory has exhibited signs of exhilaration and emancipation, is furnished by the case of Professor Haeckel of Jena. In an eloquent and popular work, entitled *Das Welt-*

Räthsel, The World-Problem, or *The Riddle of the Universe*, this eminent biologist has surveyed the whole range of existence, from the foundations of physics to the comparison of religions, from the facts of anatomy to the freedom of the will, from the vitality of cells to the attributes of God; treating these subjects with wide though by no means superhuman knowledge, and with considerable critical and literary ability. This work, through the medium of a really excellent translation by Mr. McCabe, and under the auspices of the Rationalist Press Association, has obtained a wide circulation in England, being purchasable for sixpence at any bookstall; where one often finds it accompanied by another still more popular and equally cheap treatise by the same author, a digest or summary of the religious aspect of his scientific philosophy, under the title *The Confession of Faith of a Man of Science*.

Professor Haeckel's credentials, as a learned biologist who introduced Darwinism into Germany, doubtless stand high; and it is a great tribute to his literary ability that a fairly abstruse work on so comprehensive a subject should have obtained a

wide notoriety, and have been welcomed by masses of thinking readers, especially by many among the skilled artisans, in England.

From several points of view, this diffusion of interest is most satisfactory, since the spread of thought on serious topics is greatly to be welcomed. Moreover, there is a vast mass of information in these writings which must be new to the majority of the inhabitants of Great Britain. There is also a great deal of criticism which should arouse professors of dogmatic theology and exponents of practical religion to a keener sense of their opportunities and responsibility. A view of their position from outside, by an able and unsparing critic, cannot but be illuminating and helpful, however unpleasant.

Moreover, the comprehensive survey of existence which can be taken by a modern man of science is almost sure to be interesting and instructive when, with the necessary restrictions and expansions, it is properly interpreted; and if it be found that the helpful portions are unhappily accompanied by overconfident negations and supercilious denials of facts at present outside the range of orthodox science, these natural blemishes must be discounted

and estimated at their proper worth; for it would be foolish to imagine that even a diligent student of Nature has special access to the kind of truths which have been hidden from the nominally "wise and prudent" of all time. So far as Professor Haeckel's writings are read by the thoroughly educated and well-informed, they can do nothing but good. They may not, indeed, convey anything particularly new, but they furnish an interesting study in scientific history and mental development. So far, however, as they are read by unbalanced and uncultured persons, with no sense of proportion and but little critical faculty, they may do harm, unless accompanied by a suitable qualification or antidote: especially an antidote against the bigotry of their somewhat hasty and scornful destructive portions.

To the intelligent artisan or other hard-headed reader who considers that Christian faith is undermined, and the whole religious edifice upset, by the scientific philosophy advocated by Professor Haeckel under the name "Monism," I would say, paraphrasing a sentence of Mr. Ruskin's in a preface to *Sesame and Lilies:* Do not think it likely

that you hold in your hands a treatise in which the ultimate and final verity of the universe is at length beautifully proclaimed, and in which pure truth has been sifted from the errors of all preceding ages. Do not think it, friend: it is not so.

For what is this same "Monism"?

Professor Haeckel writes almost as if it were a recent invention, but in truth, there have been many versions of it, and in one form or another, the idea is quite old, older than Plato, as old as Parmenides.

The name "Monism" should apply to any philosophic system which assumes and attempts to formulate the essential simplicity and *oneness* of all the apparent diversity of sensual impression and consciousness, any system which seeks to exhibit all the complexities of existence, both material and mental—the whole of phenomena, both objective and subjective—as modes of manifestation of one fundamental reality.

According to the assumed nature of that reality, different brands of monistic theory exist:

1. There is the hypothesis that everything is an aspect of some unknown absolute Reality, which itself, in its real nature, is far beyond our appre-

hension or conception. And within the broad area thus suggested may be grouped such utterly different universe-conceptions as that of Herbert Spencer and that of Spinoza.

2. According to another system, the fundamental reality is psychical, is consciousness, let us say, or mind; and the material world has only the reality appropriate to a consistent set of ideas. Here we find again several varieties, ranging from Bishop Berkeley and presumably Hegel, on the one hand, to William James—who, in so far as he is a monist at all, may I suppose be called an empirical idealist—and solipsists such as Mach and Karl Pearson, on the other.

3. A third system, or group of systems, has been in vogue among some physicists of an earlier day, and among some biologists now, viz., that mind, thought, consciousness, are all by-products, phantasmagoria, epiphenomena, developments, and decorations, as it were, of the one fundamental all-embracing reality, which some may call "matter," some "energy," and some "substance." In this category we find Tyndall—at any rate the Tyndall of "the Belfast address"—and here con-

sistently do we find Haeckel, together with several other biologists.

This last system of Monism, though not now in favour with philosophers, is the most militant variety of all; and accordingly, it has in some quarters managed to obtain, and it certainly seems anxious to obtain, a monopoly of the name.

But the monopoly should not be granted. The name Materialism is quite convenient for it, just as Idealism is for the opposing system; and if either of these titles is objected to by the upholders of either system, as apparently too thorough-going and exclusive, whereas only a tendency in one or other direction is to be indicated, then the longer but more descriptive titles of Idealistic-monism and Materialistic-monism respectively should be employed. But neither of these compromises seems necessary to connote the position of Professor Haeckel.

The truth is that all philosophy aims at being monistic; it is bound to aim at unification, however difficult of attainment; and a philosopher who abandoned the quest, and contented himself with a permanent antinomy—a universe compounded of

two or more irreconcilable and entirely disparate and disconnected agencies—would be held to be throwing up his brief as a philosopher and taking refuge in a kind of permanent Manichæism, which experience has shown to be an untenable and ultimately unthinkable position.

An attempt at Monism is therefore common to all philosophers, whether professional or amateur; and the only question at issue is what sort of Monism are you aiming at, what sort of solution of the universe have you to offer, what can you hold out to us as a simple satisfactory comprehensive scheme of existence?

In order to estimate the value of Professor Haeckel's scheme of the universe, it is not necessary to appeal to philosophers: it is sufficient to meet him on scientific ground, and to show that in his effort to simplify and unify he has underestimated some classes of fact and has stretched scientific theory into regions of guesswork and hypothesis, where it loses touch with real science altogether. The facts which he chooses gratuitously to deny, and the facts which he chooses vigorously to emphasise, are arbitrarily selected by him

according as they will or will not fit into his philosophic scheme. The scheme itself is no new one, and almost certainly contains elements of truth. Some day far hence, when it is possible properly to formulate it, a system of Monism may be devised which shall contain the whole truth. At present, the scheme formulated by Professor Haeckel must to philosophers appear rudimentary and antiquated, while to men of science it appears gratuitous, hypothetical, in some places erroneous, and altogether unconvincing.

Before everything, a philosopher should aim at being all-inclusive; before everything, a man of science should aim at being definite, clear, and accurate. An attempt at combination is an ambitious attempt, which may legitimately be made, but which it appears is hardly as yet given to man to make successfully. Attempts at an all-embracing scheme, which shall be both truly philosophic and truly scientific, must for the present be mistrusted, and the mistrust should extend especially to their negative side. Positive contributions, either to fact or to system, may be real and should be welcome; but negative or destructive criticism, the

eschewing and throwing away of any part of human experience, because it is inconsistent with a premature and ill-considered monistic or any other system, should be regarded with deep suspicion; and the promulgation of any such negative and destructive scheme, especially in association with free and easy dogmatism, should automatically excite mistrust and repulsion.

There are things which cannot yet be fitted in as part of a coherent scheme of scientific knowledge—at present they appear like fragments of another order of things; and if they are to be forced into the scientific framework, like portions of a "puzzle-map," before their true place has been discovered, a quantity of substantial fact must be disarranged, dislocated, and thrown away. A premature and cheap Monism is therefore worse than none at all.

CHAPTER II

THE LAW OF SUBSTANCE

I SHALL now endeavour to exhibit the way in which Professor Haeckel proceeds to expound his views, and for that purpose shall extract certain sentences from his work, *The Riddle of the Universe;* giving references to the sixpenny translation, now so widely circulated in England, in order that with ease they may be referred to in their context. To scientific men, the exaggeration of statement will in many cases be immediately obvious; but in the present state of general education, it will often be necessary to append a few comments, indicating, as briefly as possible, wherein the statement is in excess of ascertained fact, however interesting as a guess or speculation; wherefore it must be considered illegitimate as a weapon wherewith to attack other systems, so far as they too are equally entitled to be considered reasonable guesses at truth.

The central scientific doctrines upon which Pro-

fessor Haeckel's philosophy is founded appear to be two — one physical, the other biological. The physical doctrine is what he calls "the Law of Substance"—a kind of combination of the conservation of matter and the conservation of energy: a law to which he attaches extraordinary importance, and from which he draws momentous conclusions. Ultimately, he seems to regard this law as almost axiomatic, in the sense that a philosopher who has properly grasped it is unable to conceive the negative. A few extracts will suffice to show the remarkable importance which he attaches to this law:

"All the particular advances of physics and chemistry yield in theoretical importance to the discovery of the great law which brings them to one common focus, the 'law of substance.' As this fundamental cosmic law establishes the eternal persistence of matter and force, their unvarying constancy throughout the entire universe, it has become the pole-star that guides our monistic philosophy through the mighty labyrinth to a solution of the world-problem" (p. 2).

"The uneducated member of a civilised community is surrounded with countless enigmas at every step, just as truly as the savage. Their number, however, decreases with every stride of civilisation and of science; and the monistic philosophy is

ultimately confronted with but one simple and comprehensive enigma—the 'problem of substance' " (p. 6).

"The supreme and all-pervading law of nature, the true and only cosmological law, is, in my opinion, *the law of substance;* its discovery and establishment is the greatest intellectual triumph of the nineteenth century, in the sense that all other known laws of nature are subordinate to it. Under the name of 'law of substance' we embrace two supreme laws of different origin and age—the older is the chemical law of the 'conservation of matter,' and the younger is the physical law of the 'conservation of energy.' It will be self-evident to many readers, and it is acknowledged by most of the scientific men of the day, that these two great laws are essentially inseparable" (p. 75).

"The conviction that these two great cosmic theorems, the chemical law of the persistence of matter and the physical law of the persistence of force, are fundamentally one, is of the utmost importance in our monistic system. The two theories are just as intimately united as their objects—matter and force or energy. Indeed, this fundamental unity of the two laws is self-evident to many monistic scientists and philosophers, since they merely relate to two different aspects of one and the same object, the *cosmos*" (p. 76).

"I proposed some time ago to call it the 'law of substance,' or the 'fundamental cosmic law'; it might also be called the 'universal law,' or the 'law of constancy,' or the 'axiom of the constancy of the

universe.' In the ultimate analysis, it is found to be a necessary consequence of the principle of causality."

I criticise these utterances below, and in Chapter IV. I also quote extracts bearing on the subject from Professor Huxley; but meanwhile, Professor Haeckel is as positive as any Positivist, and runs no risk of being accused of Solipsism:

"Our only real and valuable knowledge is a knowledge of nature itself, and consists of presentations which correspond to external things. . . . These presentations we call *true*, and we are convinced that their content corresponds to the knowable aspect of things. We *know* that these facts are not imaginary, but real" (p. 104).

He also tends to become sentimental about the ultimate reality as he perceives it, and tries to construct from it a kind of religion:

"The astonishment with which we gaze upon the starry heavens and the microscopic life in a drop of water, the awe with which we trace the marvellous working of energy in the motion of matter, the reverence with which we grasp the universal dominance of the law of substance throughout the universe —all these are part of our emotional life, falling under the heading of 'natural religion' " (p. 122).

"Pantheism teaches that God and the world are one. The idea of God is identical with that of nature or substance. . . . In pantheism, God, as an *intra-mundane* being, is everywhere identical with nature itself, and is operative *within* the world as 'force' or 'energy.' The latter view alone is compatible with our supreme law—the law of substance. It follows necessarily that pantheism is *the world-system of the modern scientist*" (p. 102).

"This 'godless world-system' substantially agrees with the monism or pantheism of the modern scientist; it is only another expression for it, emphasising its negative aspect, the non-existence of any supernatural deity. In this sense, Schopenhauer justly remarks:

"'Pantheism is only a polite form of atheism. The truth of pantheism lies in its destruction of the dualist antithesis of God and the world, in its recognition that the world exists in virtue of its own inherent forces. The maxim of the pantheist, "God and the world are one," is merely a polite way of giving the Lord God his *congé*'" (p. 103).

Thus we are led on, from what may be supposed to be a bare statement of two recent generalisations of science,—first of all to regard them as almost axiomatic or self-evident; next, to consider that they solve the main problem of the universe; and, lastly, that they suffice to replace the Deity Himself.

To curb these extravagant pretensions, it is only necessary to consider soberly what these physical laws really assert.

Conservation of Energy

Take first the conservation of energy. This generalisation asserts that in every complete material system, subject to any kind of internal activity, the total energy of the system does not change, but is subject merely to transference and transformation, and can only be increased or diminished by passing fresh energy in or out through the walls of the system. So far from this being self-evident, it required very careful measurement and experimental proof to demonstrate the fact, for in common experience, the energy of a system left to itself continually to all appearance diminishes; yet it has been skilfully proved that when the heat and every other kind of product are collected and measured, the result can be so expressed as to show a total constancy, appertaining to a certain specially devised function called "energy," provided we know and are able to account for every form into which the said energy can be transformed by the activity

going on. A very important generalisation truly, and one which has so seized hold of the mind of the physicist that if in any actual example, a disappearance or a generation of energy were found, he would at once conclude either that he had overlooked some known form and thereby committed an error, or that some unknown form was present which he had not allowed for: thereby getting a clue which, if followed up, he would hope might result in a discovery.

But the term "energy" itself, as used in definite sense by the physicist, rather involves a modern idea and is itself a generalisation. Things as distinct from each other as light, heat, sound, rotation, vibration, elastic strain, gravitative separation, electric currents, and chemical affinity, have all to be generalised under the same heading, in order to make the law true. Until "heat" was included in the list of energies, the statement could not be made; and, a short time ago, it was sometimes discussed whether "life" should or should not be included in the category of energy. I should give the answer decidedly No, but some might be inclined to say Yes; and this is sufficient as an

example to show that the categories of energy are not necessarily exhausted; that new forms may be discovered; and that if new forms exist, until they are discovered, the law of conservation of energy as now stated may in some cases be strictly untrue; just as it would be untrue, though partially and usefully true, in the theory of machines, if heat were unknown or ignored. To jump, therefore, from a generalisation such as this, and to say, as Professor Haeckel does on page 5, that the following cosmological theorems have already been amply demonstrated, is to leap across a considerable chasm:

"1. The universe, or the cosmos, is eternal, infinite, and illimitable.

"2. Its substance, with its two attributes (matter and energy), fills infinite space, and is in eternal motion.

"3. This motion runs on through infinite time as an unbroken development, with a periodic change from life to death, from evolution to devolution.

"4. The innumerable bodies which are scattered about the space-filling ether all obey the same 'law of substance'; while the rotating masses slowly move towards their destruction and dissolution in one part of space, others are springing into new life and development in other quarters of the universe."

Most of this, though in itself probable enough, must, when scientifically regarded, be rated as guesswork, being an overpressing of known fact into an exaggerated and over-comprehensive form of statement. Let it be understood that I am not objecting to his speculations, but only pointing out that they are speculations.

The conservation of energy is a sufficiently legitimate generalisation: we do not really doubt its conservation and constancy when we admit that we are not yet sure of having fully and finally exhausted the whole category of energy. What we do grant is, that it may hereafter be possible to discover new forms; and when new forms are discovered, then either the definition may have to be modified, or else the detailed statement at present found sufficient will have to be overhauled. But, after all, this is not specially important: the *serious* mistake which people are apt to make concerning this law of energy is to imagine that it denies the possibility of guidance, control, or directing agency, whereas really it has nothing to say on these topics; it relates to *amount* alone. Philosophers have been far too apt to jump to the conclusion that because

energy is constant, therefore no guidance is possible, so that all psychological or other interference is precluded. Physicists, however, know better; though unfortunately Tyndall, in some papers on Miracles and Prayer, thoughtlessly adduced the conservation of energy as decisive. This question of "guidance" is one of great interest, and I emphasise the subject farther on.

Conservation of Matter

Take next the "conservation of matter"—which means that in any operation, mechanical, physical, or chemical, to which matter can be subjected, its amount, as measured by weight, remains unchanged; so that the only way to increase or diminish the weight of substance inside a given enclosure, or geometrically closed boundary, is to pass matter in or out through the walls.

This law has been called the sheet-anchor of chemistry, but it is very far from being self-evident; and its statement involves the finding of a property of matter which experimentally shall remain unchanged, although nearly every other property is

modified. To superficial observation, nothing is easier than to destroy matter. When liquid—when dew, for instance — evaporates, it seems to disappear and when a manuscript is burned, it is certainly destroyed; but it turns out that there is something which may be called the vapour of water, or the "matter" of the letter, which still persists, though it has taken rarer form and become unrecognisable. Ultimately, in order to express the persistence of the permanent abstraction called "matter" clearly, it is necessary to speak of the "ultimate atoms" of which it is composed, and to say that though these may enter into various combinations, and thereby display many outward forms, yet that they themselves are immutable and indestructible, constant in number and quality and form, not subject to any law of evolution; in other words, totally unaffected by time.

If we ask for the evidence on which this generalisation is founded, we have to appeal to various delicate weighings, conducted chiefly for practical purposes by chemists, and very few of them really directed to ascertain whether the law is true or not. A few such direct experiments are now, indeed,

being conducted with the hope of finding that the law is not completely true; in other words, with the hope of finding that the weight of a body does depend slightly on its state of aggregation or on some other physical property. The question has even been raised whether the weight of a crystal is altogether independent of its *aspect:* the direction of its plane of cleavage with reference to the earth's radius; also, whether the temperature of bodies has any influence on their weight; but on these points it may be truly said that if any difference were discovered it would not be expressed by saying that the amount of matter was different, but simply that "weight" was not so fundamental and inalienable a property of matter as has been sometimes assumed; in which case, it is clear that there must be a more fundamental property to which appeal can be made in favour of constancy or persistency or conservation. Now the most fundamental property of matter known is undoubtedly "inertia"; and the law of conservation would therefore come to mean that the *inertia* of matter was constant, no matter what changes it underwent. But, then, inertia is not an easy property to measure, — very difficult to

measure with great accuracy: it is in practice nearly always *inferred* from weight; and in terms of inertia, the law of conservation of matter cannot be considered really an experimental fact; it is, strictly speaking, a reasonable hypothesis, an empirical law, which we have never seen any reason to doubt, and in support of which all scientific experience may be adduced in favour.

It is possible, however, to grant to Professor Haeckel—not positively, but for the sake of argument, and giving him the benefit of our present ignorance—that it is unlikely that matter in its lowest denomination can by us be created or destroyed. For, although it is now pretty well known that atoms of matter are not the indestructible and immutable things they were once thought (seeing that although we do not know how to break them up, they are liable every now and then themselves to break up or explode, and so resolve themselves into simpler forms), yet it can be granted that these simpler forms are likewise themselves atoms, in the same sense, and that if they break up they will break up likewise into atoms; or ultimately, it may be, into those corpuscles or electrons or electric

charges, of which one plausible theory conjectures that the atoms of matter are really composed.

Supposing an atom thus broken up into electrons, its weight may possibly have disappeared. We simply do not know whether weight is a property of the grouping called an atom, or whether it belongs also to the individual ingredients or corpuscles of that atom. There is at present no evidence. But whether weight has disappeared or not, it is quite certain, for definite though rather recondite theoretical reasons, that the inertia would *not* have disappeared; and accordingly it may be held, and must be held in our present state of knowledge, that the constancy of fundamental material still holds good, even though the atoms are resolved into electric charges—an amount of destruction never contemplated by those chemists and physicists who promulgated the doctrine of the conservation of matter.

Electrical Theory of Matter

But then, on the electrical theory of matter, even *inertia* is not the thoroughly constant property we once thought it. It is a function of velocity for one

thing, and when speeds become excessive, the inertia of matter rises perceptibly in value. The fact that it would rise in value by a calculable amount, and that the rise would be perceptible when the speed of motion approached in value to within, say, a tenth of the velocity of light, was predicted mathematically[1]; and now, strange to say, it has recently become possible to observe and actually measure the increase of inertia experimentally, and thus to confirm the electrical theory not only as qualitatively or approximately true, but as completely and quantitatively accurate. A remarkable achievement all this! of quite modern times, which has not excited the attention it deserves — save among physicists.

But even this is not all that can be said as to the fluctuating character of that fundamental material quality "inertia." It appears possible, if electrons approach too near each other, so as to encroach on each other's magnetic field as they move, that then their inertia may fall in value during the time they are contiguous. No experimental fact has yet suggested this at present: it is improbable that even

[1] By Mr. Oliver Heaviside and Prof. J. J. Thomson.

in the tightest combinations they ever really approach close enough to each other to make the effect appreciable in the slightest degree; still, strictly speaking, the inertia of matter is a known mathematical function of the distance of electrons apart, compared with their size, as well as of their absolute speed through the ether, and hence it may be found to vary from either of two distinct reasons. Nevertheless, even this variation would not be expressed as a failure in the conservation of matter, though there is now no single material property that can be specified as really and genuinely constant. So long as the electric centres of strain, or whatever they are,—so long as the electric charges themselves,—continue unaltered, we should prefer to say that at least the *basis* of matter was fundamentally conserved.

Further than this, however, we cannot go; and to say, as Professor Haeckel says, that the modern physicist has grown so accustomed to the conservation of matter that he is unable to conceive the contrary, is simply untrue. Whatever may be the case in real fact, there is no question with respect to the possibility of conception. The electrons

themselves must be explained somehow; and the only surmise which at present holds the field is that they are knots or twists or vortices, or some sort of either static or kinetic modification, of the ether of space—a small bit partitioned off from the rest and individualised by reason of this identifying peculiarity. It may be that these knots cannot be untied, these twists undone, these vortices broken up; it may be that neither artificially nor spontaneously are they ever in the slightest degree changed. It may be so, but we do not know; and it is quite easy to conceive them broken up, the identity of the electron lost, its substance resolved into the original ether, without parts or individual properties. If this happened within our ken, we should have to confess that the properties of matter were gone, and that hence everything that could by any stretch of language be called "matter" was destroyed, since no identifying property remained. The discovery of such an event may lie in the science of the future; it would be an epoch-making event in the history of science, but no physicist would be upset by it, perhaps not even surprised; nor would any one have good reason to be aston-

ished if the correlative phenomenon occurred, and under certain conditions some knots or strains were some day caused in the ether, which had not been previously there, and so "matter," or the foundation of matter, artificially produced; in other words, the destruction and the creation of matter are well within the range of scientific conception, and may be within the realm of experimental possibility.

Persistence of the Existent

Is there, then, no meaning in the conception which Professor Haeckel and others have so enthusiastically formulated, and which certainly commends itself to every one as representing in some sense a genuine truth, whether it be called a "law of substance" or whatever it be called? There does seem a certain plausibility in the idea, pure guess or assumption though it be, that anything which really and fundamentally exists, in a serious and untrivial and non-accidental sense, can be trusted not suddenly to go out of existence and leave no trace behind. In other words, there seems some reason to suppose that anything which actually *exists* must be in some way or other perpetual; that real

existence is not a capricious and changing attribute: arbitrary collocations and accidental relations may and must be temporary, but there may be in each a fundamental substratum which, if it can be reached, will be found to be eternal. I develop this idea further in the sequel. This is, at any rate, what Professor Haeckel was evidently groping after, as many others have groped before him, and the nature of this fundamental persistent entity or entities (for we must not assume without proof that there is only one: there may be several, and at any rate, their ultimate unification may be a still further advanced and more transcendental problem) may with some appropriateness be called "the problem of the universe," since it is clearly the problem of existence. Professor Haeckel thinks he has solved the problem, grasped the fundamental reality, and found it to be *matter and energy* and nothing else; though why he chooses to consider matter and energy as one thing instead of two is not perfectly plain to me, nor, I venture to say, is it really plain to him.

Making the assumption, then, that there is something, or that there are several things, to be

discovered, which may thus have the most fundamental property, viz., persistent immutable existence, the "problem" has resolved itself into the discovery of what these things actually are. It will not do to jump at some object and assume that that is it.

A multitude of things obviously perish, thereby showing themselves to be trivial or accidental arrangements, according to our hypothesis: A flame is extinguished and dies; a mountain is ultimately ground into sand by the slow influence of denudation; a planet or a sun may lose its identity by encounter with other bodies. All these are temporary collocations of atoms; but it appears now that an atom may break up into electric charges, and these again may some day be found capable of resolving themselves into pristine ether. If so, then these also are temporary, and, in the material universe, it is the ether only which persists, —the ether with such states of motion or strain as it eternally possesses,—in which case the ether will have proved itself the material substratum and most fundamental known entity on that side.

But are we to conclude, therefore, that nothing else exists? that the existence of one thing

disproves the existence of others? The contention would be absurd. The category of *life* has not been touched in anything we have said so far; no relation has been established between life and energy, or between life and ether. The nature of life is unknown. Is life also a thing of which constancy can be asserted? When it disappears from a material environment is it knocked out of existence, or is it merely transferred to some other surroundings, becoming as difficult to identify and recognise as are the gases of a burnt manuscript or the vapour of a vanished cloud? Is it a temporary trivial collocation associated with certain complex groupings of the atoms of matter, and resolved into nothingness when that grouping is interfered with? or is it something immaterial and itself fundamental, something which uses these collocations of matter in order to display itself amid material surroundings, but is otherwise essentially independent of them? (This idea is expanded in Chapters VI. to X.)

Professor Haeckel would answer this question with a contemptuous negative, and the treatment which he would thus give to life he would also extend to mind and consciousness, to affection, to art,

to poetry, to religion, and all the other facts of experience to which in the process of evolution humanity has risen: I say he would answer the question, whether these had any real existence other than as a necessary concomitant of a sufficiently complex material aggregate, with a contemptuous negative; but I challenge him to say by what right he gives that answer. His speculation is that all these properties are nascent and latent in the material atoms themselves; that these have the potentiality of life and choice and consciousness, which we perceive in their developed combinations. As a speculation this is legitimate; but the only answer that can by science legitimately be given at the present time is the answer given by Du Bois-Reymond, "*Ignoramus*," (we do not know).

Scientifically we do not; and for a man of science to pretend, or to assert in a popular treatise, that we do, is essentially and seriously to mislead. (See Chapter VII. below.) It may even be a question whether the assertion of entire ignorance at the present time is completely appropriate; whether we have not some positive evidence *against* Professor Haeckel's contention. I believe that we have; and

though I may acquiesce in an assertion of present ignorance, I am not at all willing to accept the next sentence of Professor du Bois-Reymond's answer, and to say "*Ignorabimus*," (we never shall know).

The matter seems to me within the legitimate lines of scientific inquiry, and it is unwise to attempt prediction, especially negative prediction, or to attempt to close the door to the future developments of knowledge.

But I am content to say for the present that from the point of view of strict science it is not yet possible to give any positive answer to these questions; that they must await the progress of discovery. It becomes a question of some interest, therefore, how it is possible for Professor Haeckel and for others of his school to have arrived at the idea not only that a scientific answer can be given, but that already it has been given, and that they know distinctly what it is.

CHAPTER III

THE DEVELOPMENT OF LIFE

THIS leads me to the second main thesis or central scientific doctrine of Professor Haeckel's treatise, the biological one; and it is this which I shall now proceed to illustrate by further quotations, viz., the connection as he conceives it between life and matter.

His view is that life has arisen from inorganic matter without antecedent life. The experimental facts of biogenesis he discards in favour of a hypothetical and at present undiscovered kind of spontaneous generation. He assumes that the chemico-physical properties of carbon confer so peculiar a power on its albuminoid compounds that they develop into living protoplasm. He says that he formulated this view thirty-three years ago, and that no better monistic theory has arisen to replace

it, while to reject some form of spontaneous generation is to admit a miracle:

"The hypothesis of spontaneous generation and the allied carbon-theory (viz., that 'carbon . . . may be considered the chemical basis of life,' p. 2) are of great importance in deciding the long-standing conflict between the *teleological* (dualistic) and the *mechanical* (monistic) interpretation of phenomena" (p. 91).

But it can hardly be maintained that a "hypothesis" is able to "decide" any dispute.

An unscientific reader could hardly imagine that the apparently detailed account given in the next sentence of the automatic origin of life, as it may have arisen on other planes, and as it must have arisen on this, is of the nature of hypothesis:

"First simple monera are formed by spontaneous generation, and from these arise unicellular protists. . . . From these unicellular protists arise, in the further course of evolution, first social cell-communities, and subsequently tissue-forming plants and animals" (p. 131).

In this hypothesis of automatic origin by the agency of matter and energy alone, he could probably find many biologists to agree with him

speculatively; but he goes further than most of them, for he does not limit the automatic or material development to animal and vegetable life alone: he throws automatic consciousness in, too:

"The 'cellular theory' . . . has given us the first true interpretation of the physical, chemical, and even the psychological, processes of life" (p. 1).

"Consciousness, thought, and speculation are functions of the ganglionic cells of the cortex of the brain" (p. 6).

"The peculiar phenomenon of consciousness is not, as Du Bois-Reymond and the dualistic school would have us believe, a completely 'transcendental' problem: it is, as I showed thirty-three years ago, a *physiological* problem, and as such, must be reduced to the phenomena of physics and chemistry" (p. 65).

Holding such a view concerning consciousness, in the teeth of the general philosophic opinion of to-day, it is natural to find that of orthodox psychology and psychologists he is contemptuous:

"Most of our so-called 'psychologists' have little or no knowledge of these indispensable foundations of anthropology, anatomy, histology, ontogeny, and physiology. . . . Hence it is that most of the psychological literature of the day is so much waste-paper" (p. 34).

"What we call the soul is, in my opinion, a natural phenomenon; I therefore consider psychology to be a branch of natural science—a section of physiology. Consequently, I must emphatically assert from the commencement that we have no methods of research for that science different from those for any of the others" (p. 32).

In this difficult science of psychology, he evidently feels himself quite at home. He assumes easily and gratuitously that there is a material substance at the root of all mental processes whatever —called by Clifford "mind-stuff" (see, however, Chapter IV. below),—and he then proceeds to lay down the law concerning ancient difficulties, as follows:

"We shall give to this material basis of all psychic activity, without which it is inconceivable, the provisional name of 'psychoplasm.'

"The psychic processes are subject to the supreme, all-ruling law of substance; not even in this province is there a single exception to this highest cosmological law.

"The dogma of 'free-will,' another essential element of the dualistic psychology, is similarly irreconcilable with the universal law of substance" (p. 32).

"The freedom of the will is not an object for critical scientific inquiry at all, for it is a pure

dogma, based on an illusion, and has no real existence" (p. 6).

Nevertheless, he realises that its apparent existence has to be accounted for somehow, and accordingly, he adopts the view that has several times occurred to thinkers, viz., that the nucleus of all the faculties enjoyed by a complete organism must be attributed in germ or nucleus to the cells and even to the atoms out of which the organism is built up.

His speculation as to the formation of a conscious organism, and to the real meaning of its apparent sense of right and wrong and its apparent control over its own acts, runs as follows, the will being reduced to attraction and repulsion between the atoms:

"Vogt's pyknotic theory of substance is that minute parts of the universal substance, the centres of condensation, which might be called *pyknatoms*, correspond in general to the ultimate separate atoms of the kinetic theory; they differ, however, very considerably in that they are credited with sensation and inclination (or will-movement of the simplest form), *with souls*, in a certain sense,—in harmony with the old theory of Empedocles of the 'loves and hatreds of the elements.'

"Moreover, these 'atoms with souls' do not float in empty space, but in the continuous, extremely attenuated, intermediate substance, which represents the uncondensed portion of the primitive matter" (p. 77).

" 'Attraction' and 'repulsion' seem to be the sources of *will*—that momentous element of the soul which determines the character of the individual" (p. 45).

"The positive ponderable matter, the element with the feeling of like or desire, is continually striving to complete the process of condensation, and thus collecting an enormous amount of *potential* energy; the negative imponderable matter, on the other hand, offers a perpetual and equal resistance to the further increase of its strain and of the feeling of dislike connected therewith, and thus gathers the utmost amount of *actual* energy.

"I think that this pyknotic theory of substance will prove more acceptable to every biologist who is convinced of the unity of nature than the kinetic theory which prevails in physics to-day" (p. 78).

In other words, he appeals to a presumed sentiment of biologists against the knowledge of the physicist in his own sphere—a strange attitude for a man of science. After this, it is less surprising to find him ignoring the elementary axiom that "action and reaction are equal and opposite," *i. e.*, that internal forces can have no motive power on a

body as a whole, and making the grotesque assertion that matter is moved, not by external forces, but by internal likes and desires:

"I must lay down the following theses, which are involved in Vogt's pyknotic theory, as indispensable for a truly monistic view of substance, and one that covers the whole field of organic and inorganic nature:

"1. The two fundamental forms of substance, ponderable matter and ether, are not dead and only moved by extrinsic force, but they are endowed with sensation and will (though, naturally, of the lowest grade); they experience an inclination for condensation, a dislike of strain; they strive after the one and struggle against the other" (p. 78).

My desire is to criticise politely, and hence I refrain from characterising this sentence as a physicist should.

"Every shade of inclination, from complete indifference to the fiercest passion, is exemplified in the chemical relation of the various elements towards each other" (p. 79).

"On those phenomena we base our conviction that even the *atom* is not without a rudimentary form of sensation and will, or, as it is better expressed, of feeling (*æsthesis*) and inclination (*tropesis*) —that is, a universal 'soul' of the simplest character" (p. 80).

"I gave the outlines of *cellular* psychology in 1866 in my paper on 'Cell-souls and Soul-cells'" (p. 63).

Thus, then, in order to explain life and mind and consciousness by means of matter, all that is done is to assume that matter possesses these unexplained attributes.

What the full meaning of that may be, and whether there be any philosophic justification for any such idea, is a matter on which I will not now express an opinion; but, at any rate, as it stands, it is not science, and its formulation gives no sort of conception of what life and will and consciousness really are.

Even if it were true, it contains nothing whatever in the nature of explanation: it recognises the inexplicable, and relegates it to the atoms, where it seems to hope that further quest may cease. Instead of tackling the difficulty where it actually occurs; instead of associating life, will, and consciousness with the organisms in which they are actually in experience found, these ideas are foisted into the atoms of matter; and then the properties which have been conferred on the atoms are denied

in all essential reality to the fully developed organisms which those atoms help to compose!

I show later on (Chapters V. and X.) that there is no necessary justification for assuming that a phenomenon exhibited by an aggregate of particles must be possessed by the ingredients of which it is composed; on the contrary, wholly new properties may make their appearance simply by aggregation; though I admit that such a proposition is by no means obvious, and that it may be a legitimate subject for controversy. But into that question our author does not enter; and even when he has conferred on the atoms these astounding properties, he abstains from what would seem a natural development: for his doctrine is that our power is actually less than that of the atoms,—that instead of utilising the attractions and repulsions, or "likes and dislikes," of our constituent particles, and directing them by the aggregate of conscious will-power to some preconceived end, we ourselves, on the contrary, are dominated and controlled by *them;* so that freedom of the will is an illusion.

Freedom being thus disposed of, immortality presents no difficulty; a soul is the operation of a

group of cells, and so the existence of man clearly begins and ends with that of his terrestrial body:

"The most important moment in the life of every man, as in that of all other complex animals, is the moment in which he begins his individual existence [coalescence of sperm cell and ovum] . . . the existence of the personality, the independent individual, commences. This ontogenetic fact is supremely important, for the most far-reaching conclusions may be drawn from it. In the first place, we have a clear perception that man, like all the other complex animals, inherits all his personal characteristics, bodily and mental, from his parents; and further, we come to the momentous conclusion that the new personality which arises thus can lay no claim to 'immortality' " (p. 22).

Others besides Haeckel have held this kind of view at one time or another; but, unlike him, most of them have recanted and seen the error of their ways. He is, indeed, aware that several of his great German contemporaries have been through this phase of thought and come out on the other side, notably the physiologist Wundt, and he refers to them fairly and instructively thus:

"What seems to me of special importance and value in Wundt's work is that he 'extends the law

of the persistence of force for the first time to the psychic world.'

"Thirty years afterwards, in a second edition, Wundt emancipated himself from the fundamental errors of the first, and says that he 'learned many years ago to consider the work a sin of his youth'; it 'weighed on him as a kind of crime, from which he longed to free himself as soon as possible.' In the first, psychology is treated as a *physical* science, on the same laws as the whole of physiology, of which it is only a part; thirty years afterwards, he finds psychology to be a *spiritual* science, with principles and objects entirely different from those of physical science.

"I myself," says Haeckel, " naturally consider the 'youthful sin' of the young physiologist Wundt to be a correct knowledge of nature, and energetically defend it against the antagonistic view of the old philosopher Wundt. This entire change of philosophical principles, which we find in Wundt, as we found it in Kant, Virchow, Du Bois-Reymond, Carl Ernst Baer, and others, is very interesting" (p. 36).

So it is: very interesting!

Professor Haeckel is so imbued with biological science that he loses his sense of proportion; and his enthusiasm for the work of Darwin leads him to attribute to it an exaggerated scope, and enables him to eliminate the third of the Kantian trilogy:

"Darwin's theory of the natural origin of species

at once gave us the solution of the mystic 'problem of creation,' the great 'question of all questions'—the problem of the true character and origin of man himself'' (p. 28).

It is a great deal more than that patient observer and deep thinker, Charles Darwin, ever claimed, nor have his wiser disciples claimed it for him. It is familiar that he explained how variations once arisen would be clinched, if favourable in the struggle, by the action of heredity and survival; but the source or origin of the variations themselves he did not explain.

Do they arise by guidance or by chance? Is natural selection akin to the verified and practical processes of artificial selection? or is it wholly alien to them and influenced by chance alone? The latter view can hardly be considered a complete explanation, though it is verbally the one adopted by Professor Haeckel, and it is of interest to see what he means by chance:

''Since impartial study of the evolution of the world teaches us that there is no definite aim and no special purpose to be traced in it, there seems to be no alternative but to leave everything to 'blind chance.'

"One group of philosophers affirms, in accordance with its teleological conception, that the whole cosmos is an orderly system, in which every phenomenon has its aim and purpose; there is no such thing as chance. The other group, holding a mechanical theory, expresses itself thus: The development of the universe is a monistic mechanical process, in which we discover no aim or purpose whatever; what we call design in the organic world is a special result of biological agencies; neither in the evolution of the heavenly bodies nor in that of the crust of our earth do we find any trace of a controlling purpose—all is the result of chance. Each party is right—according to its definition of chance. The general law of causality, taken in conjunction with the law of substance, teaches us that every phenomenon has a mechanical cause; in this sense, there is no such thing as chance. Yet it is not only lawful, but necessary, to retain the term for the purpose of expressing the simultaneous occurrence of two phenomena, which are not causally related to each other, but of which each has its own mechanical cause, independent of that of the other.

"Everybody knows that chance, in this monistic sense, plays an important part in the life of man and in the universe at large. That, however, does not prevent us from recognising in each 'chance' event, as we do in the evolution of the entire cosmos, the universal sovereignty of nature's supreme law, *the law of substance*" (p. 97).

Illegitimate Negations

With regard to the possibility of Revelation, or information derived from superhuman sources, naturally he ridicules the idea; but, in connection with the mode of origin and development of life on this planet, he makes the following sensible and noteworthy admission:

"It is very probable that these processes have gone on likewise on other planets, and that other planets have produced other types of the higher plants and animals, which are unknown on our earth; perhaps from some higher animal stem, which is superior to the vertebrate in formation, higher beings have arisen who far transcend us earthly men in intelligence."

Exactly; it is quite probable. It is, in fact, improbable that man is the highest type of existence. But if Professor Haeckel is ready to grant that probability or even possibility, why does he so strenuously exclude the idea of revelation, *i. e.*, the acquiring of imparted information from higher sources? Savages can certainly have "revelation" from civilised men. Why, then, should it be inconceivable that human beings should receive information from beings in the universe higher than

themselves? It may or may not be the case that they do; but there is no scientific ground for dogmatism on the subject, nor any reason for asserting the inconceivability of such a thing.

Professor Haeckel would no doubt reply to some of the above criticism that he is not only a man of science, but also a philosopher; that he is looking ahead, beyond ascertained fact, and that it is his philosophic views which are in question rather than his scientific statements. To some extent, it is both, as has been seen; but even if the above be widely known—if it be generally understood that the most controversial portions of his work are mainly speculative and hypothetical, it can be left to its proper purpose of doing good rather than harm. It can only do harm by misleading: it can do considerable good by criticising and stimulating and informing; and it is an interesting fact that a man so well acquainted with biology as Professor Haeckel is should have been so strongly impressed with the truth of some aspect of the philosophic system known as Monism. Many men of science have likewise been impressed with the probability, or possibility, of some such ultimate unification.

The problem to be solved—and an Old-World problem indeed it is—is the range, and especially the nature, of the connection between mind and matter; or, let us say, between the material universe on the one hand, and the vital, the mental, the conscious, and spiritual universe or universes, on the other.

It would be extremely surprising if any attempt yet made had already been thoroughly successful, though the attack on the idealistic side appears to many of us physicists to be by far the most hopeful line of advance. An excessively wide knowledge of existence would seem to be demanded for the success of any such most ambitious attempt; but, though none of us may hope to achieve it, many may strive to make some contribution towards the great end; and those who think they have such a contribution to make, or such a revelation entrusted to them, are bound to express it to the best of their ability, and leave it to their contemporaries and successors to assimilate such portions of it as are true, and to develop it further. From this point of view, Professor Haeckel is no doubt amply justified in his writings; but, unfortunately, it appears

to me that although he has been borne forward on the advancing wave of monistic philosophy, he has, in its specification, attempted such precision of materialistic detail, and subjected it to so narrow and limited a view of the totality of experience, that the progress of thought has left him, as well as his great English exemplar, Herbert Spencer, somewhat high and dry, belated and stranded by the tide of opinion which has now begun to flow in another direction. He is, as it were, a surviving voice from the middle of the nineteenth century; he represents, in clear and eloquent fashion, opinions which then were prevalent among many leaders of thought — opinions which they themselves in many cases, and their successors still more, lived to outgrow; so that by this time Professor Haeckel's voice is as the voice of one crying in the wilderness, not as the pioneer or vanguard of an advancing army, but as the despairing shout of a standard-bearer, still bold and unflinching, but abandoned by the retreating ranks of his comrades as they march to new orders in a fresh and more idealistic direction.

CHAPTER IV

MEMORANDA FOR WOULD-BE MATERIALISTS

THE objection which it has been found necessary to express concerning Materialism as a complete system is based not on its assertions, but on its negations. In so far as it makes positive assertions, embodying the results of scientific discovery and even of scientific speculation based thereupon, there is no fault to find with it; but when, on the strength of that, it sets up to be a philosophy of the universe—all-inclusive, therefore, and shutting out a number of truths otherwise perceived, or which appeal to other faculties, or which are equally true and are not really contradictory of legitimately materialistic statements—then it is that its insufficiency and narrowness have to be displayed.

It will probably be instructive, and it may be sufficient, if I show that two great leaders in scientific thought (one the greatest of all men of science

who have yet lived), though well aware of much that could be said positively on the materialistic side, and very willing to admit or even to extend the province of science or exact knowledge to the uttermost, yet were very far from being philosophic Materialists or from imagining that other modes of regarding the universe were thereby excluded.

Great leaders of thought, in fact, are not accustomed to take a narrow view of existence or to suppose that one mode of regarding it, or one set of formulæ expressing it, can possibly be sufficient and complete. Even a sheet of paper has two sides; a terrestrial globe presents different aspects from different points of view; a crystal has a variety of facets; and the totality of existence is not likely to be more simple than any of these—is not likely to be readily expressible in any form of words, or to be thoroughly conceivable by any human mind.

It may be well to remember that Sir Isaac Newton was a Theist of the most pronounced and thorough conviction, although he had a great deal to do with the reduction of the major Cosmos to mechanics, *i. e.*, with its explanation by the elaborated machinery of simple forces; and he conceived

it possible that, in the progress of science, this process of reduction to mechanics would continue till it embraced nearly all phenomena. (See extract below.) That, indeed, has been the effort of science ever since, and therein lies the legitimate basis for materialistic statements, though not for a materialistic philosophy.

The following sound remarks concerning Newton are taken from Huxley's *Hume*, p. 246:

"Newton demonstrated all the host of heaven to be but the elements of a vast mechanism, regulated by the same laws as those which express the falling of a stone to the ground. There is a passage in the preface to the first edition of the *Principia*, which shows that Newton was penetrated, as completely as Descartes, with the belief that all the phenomena of nature are expressible in terms of matter and motion:

"'WOULD THAT THE REST OF THE PHENOMENA OF NATURE COULD BE DEDUCED BY A LIKE KIND OF REASONING FROM MECHANICAL PRINCIPLES. FOR MANY CIRCUMSTANCES LEAD ME TO SUSPECT THAT ALL THESE PHENOMENA MAY DEPEND UPON CERTAIN FORCES, IN VIRTUE OF WHICH THE PARTICLES OF BODIES, BY CAUSES NOT YET KNOWN, ARE EITHER MUTUALLY IMPELLED AGAINST ONE ANOTHER, AND COHERE INTO REGULAR FIGURES, OR REPEL AND RECEDE FROM ONE ANOTHER;

WHICH FORCES BEING UNKNOWN, PHILOSOPHERS HAVE AS YET EXPLORED NATURE IN VAIN. BUT I HOPE THAT, EITHER BY THIS METHOD OF PHILOSOPHISING, OR BY SOME OTHER AND BETTER, THE PRINCIPLES HERE LAID DOWN MAY THROW SOME LIGHT UPON THE MATTER.'"

Here is a full-blown anticipation of an intelligible exposition of the universe in terms of matter and force: the substantial basis of what smaller men call Materialism and develop into what they consider to be a materialistic philosophy. But there is no necessity for anything of the kind; a systematic expression of facts in terms of one of their aspects does not exclude expression in terms of other and totally different aspects also. Denial of all sides but one is a poor kind of unification. Denial of this sort is the weakness and delusion of the people who call themselves "Christian Scientists": they have hold of one side of truth—and that should be granted them,—but they hold it in so narrow and insecure a fashion that, in self-defence, they think it safest strenuously to deny the existence of all other sides. In this futile enterprise, they are imitating the attitude of the philosophic Materialists, on the other side of the controversy.

And then, again, Professor Huxley himself, who is commonly spoken of by half-informed people as if he were a philosophic Materialist, was really nothing of the kind; for although, like Newton, fully imbued with the mechanical doctrine, and, of course, far better informed concerning the biological departments of nature and the discoveries which in the last century have been made, and though he rightly regarded it as his mission to make the scientific point of view clear to his benighted contemporaries, and was full of enthusiasm for the facts on which Materialists take their stand, he saw clearly that these alone were insufficient for a philosophy. The following extracts from the *Hume* volume will show, first, that he entirely repudiated Materialism as a satisfactory or complete scheme of things; and, secondly, that he profoundly disagreed with the position which now appears to be occupied by Professor Haeckel. Especially is he severe on gratuitous denials applied to provinces beyond our scope, saying that

"while it is the summit of human wisdom to learn the limit of our faculties, it may be wise to recollect that we have no more right to make denials,

than to put forth affirmatives, about what lies beyond that limit. 'Whether either mind or matter has a 'substance' or not is a problem which we are incompetent to discuss; and it is just as likely that the common notions upon the subject should be correct as any others. . . . 'The same principles which, at first view, lead to scepticism, pursued to a certain point bring men back to common sense' " (p. 282).

And on p. 286 he speaks concerning "substance" —that substance which constitutes the foundation of Haeckel's philosophy—almost as if he were purposely confuting that rather fly-blown production:

"Thus, if any man think he has reason to believe that the '*substance*' of matter, to the existence of which no limit can be set either in time or space, is the infinite and eternal substratum of all actual and possible existences, which is the doctrine of philosophical materialism, as I understand it, I have no objection to his holding that doctrine; and I fail to comprehend how it can have the slightest influence upon any ethical or religious views he may please to hold. . . .

"Moreover, the ultimate forms of existence which we distinguish in our little speck of the universe are, possibly, only two out of infinite varieties of existence, not only analogous to matter and analogous to mind, but of kinds which we are not competent so much as to conceive—in the midst of

which, indeed, we might be set down, with no more notion of what was about us than the worm in a flower-pot, on a London balcony, has of the life of the great city.

"That which I do very strongly object to is the habit, which a great many non-philosophical materialists unfortunately fall into, of forgetting all these very obvious considerations. They talk as if the proof that the 'substance of matter' was the 'substance' of all things cleared up all the mysteries of existence. In point of fact, it leaves them exactly where they were. . . . Your religious and ethical difficulties are just as great as mine. The speculative game is drawn—let us get to practical work" (p. 286).

And again on pp. 251 and 279:

"It is worth any amount of trouble to . . . know by one's own knowledge the great truth . . . that the honest and rigorous following up of the argument which leads us to 'materialism' inevitably carries us beyond it" (p. 251).

"To sum up. If the materialist affirms that the universe and all its phenomena are resolvable into matter and motion, Berkeley replies, True; but what you call matter and motion are known to us only as forms of consciousness; their being is to be conceived or known; and the existence of a state of consciousness, apart from a thinking mind, is a contradiction in terms.

"I conceive that this reasoning is irrefragable.

And, therefore, if I were obliged to choose between absolute materialism and absolute idealism, I should feel compelled to accept the latter alternative" (p. 279).

Let the jubilant but uninstructed and comparatively ignorant amateur Materialist therefore beware, and bethink himself twice or even thrice before he conceives that he understands the universe and is competent to pour scorn upon the intuitions and perceptions of great men in what may be to him alien regions of thought and experience.

Let him explain, if he can, what he means by his own identity, or the identity of any thinking or living being, which at different times consists of a totally different set of material particles. Something there clearly is which confers personal identity and constitutes an individual: it is a property characteristic of every form of life, even the humblest; but it is not yet explained or understood, and it is no answer to assert gratuitously that there is some fundamental "substance" or material basis on which that identity depends, any more than it is an explanation to say that it depends upon a "soul." These are all forms of words. As Hume

says, quoted by Huxley with approval in the work already cited:

"It is impossible to attach any definite meaning to the word 'substance,' when employed for the hypothetical substratum of soul and matter. . . . If it be said that our personal identity requires the assumption of a substance which remains the same while the accidents of perception shift and change, the question arises, What is meant by personal identity? . . . A plant or an animal, in the course of its existence, from the condition of an egg or seed to the end of life, remains the same neither in form, nor in structure, nor in the matter of which it is composed: every attribute it possesses is constantly changing, and yet we say that it is always one and the same individual" (p. 194).

And in his own preface to the *Hume* volume, Huxley expresses himself forcibly thus,—equally antagonistic, as was his wont, both to ostensible friend and ostensible foe, as soon as they got off what he considered the straight path:

"That which it may be well for us not to forget is, that the first-recorded judicial murder of a scientific thinker [Socrates] was compassed and effected, not by a despot, nor by priests, but was brought about by eloquent demagogues. . . . Clear knowledge of what one does not know just as important as knowing what one does know. . . .

"The development of exact natural knowledge in all its vast range, from physics to history and criticism, is the consequence of the working out, in this province, of the resolution to 'take nothing for truth without clear knowledge that it is such'; to consider all beliefs open to criticism; to regard the value of authority as neither greater nor less than as much as it can prove itself to be worth. The modern spirit is not the spirit 'which always denies,' delighting only in destruction; still less is it that which builds castles in the air rather than not construct; it is that spirit which works and will work, 'without haste and without rest,' gathering harvest after harvest of truth into its barns, and devouring error with unquenchable fire" (p. viii.).

The harvesting of truth is a safe enough enterprise, but the devouring of error is a more dangerous pastime, since flames are liable to spread beyond our control; and though, in a world overgrown with weeds and refuse, the cleansing influence of fire is a necessity, it would be cruel to apply the same agency again at a later stage, when a fresh young crop is springing up in the cleared ground.

CHAPTER V

RELIGION AND PHILOSOPHY

THE aphorism sometimes encountered, that "whatever properties appertain to a whole must essentially belong to the parts of which it is composed," is a fallacy. A property can be possessed by an aggregation of atoms which no atom possesses in the slightest degree. Those who think otherwise are unacquainted with mathematical laws other than simple proportion or some continuous or additive functions; they are not aware of discontinuities; they are not experienced in critical values, above which certain conditions obtain, while below them there is suddenly nothing. To refute them, an instance must suffice:

A meteoric stone may seem to differ from a planet only in size, but the difference in size involves also many other differences, notably the fact that the larger body can attract and hold to itself an atmosphere — a circumstance of the utmost

importance to the existence of life on its surface. In order, however, that a planet may by gravitative attraction control the roving atoms of gas, and confine their excursions to within a certain range of itself, it must have a very considerable mass.

The earth is big enough to do it; the moon is not. By simply piling atoms or stones together into a mighty mass there comes a critical point at which an atmosphere becomes possible; and directly an atmosphere exists, all manner of phenomena may spring into existence, which without it were quite impossible.

So, also, it may be said that a sun differs from a dark planet only in size; for it is just the fact of great size which enables its gravitative-shrinkage and earthquake-subsidence to generate an immense quantity of heat and to maintain the mass for æons at an excessively high temperature, thereby fitting it to become the centre of light and life to a number of worlds. The blaze of the sun is a property which is the outcome of its great mass. A small permanent sun is an impossibility.

Wherefore, properties can be possessed by an aggregate or assemblage of particles which in the

particles themselves did not in the slightest degree exist.

If, however, we reverse the aphorism and say that whatever is in a part must be in the whole, we are on much safer ground. I do not say that it cannot be pressed into illegitimate extremes, but in one, and that the simplest, sense it is little better than a platitude. The fact that an apple has pips legitimises the assertion that an apple-tree has pips, and that the peculiar property of pips represents a faculty enjoyed by the vegetable kingdom as a whole; but it would be a childish misunderstanding to expect to find actual pips in the trunk of a tree or in all vegetables.

There is a tendency to call the argument or statement that, whatever faculty man possesses, the Deity must have also, by the term "Anthropomorphism"; but it seems to me a misnomer, and to convey quite wrong ideas. The argument represented by "He that formed the eye, shall he not see? he that planted the ear, shall he not hear?" need not assume for a moment that God has sense organs akin to those of man, or that He appreciates ethereal and aërial vibrations in the same sort of way. It

is not an assertion of similarity between God and man, but merely a realisation that what belongs to a part *must* be contained in the whole. It is not even necessarily pantheistic: it would hold equally well on a theistic interpretation. Regarded pantheistically, it is obvious and requires no stating, regarded theistically, it is a perception that faculties and powers which have come into existence, and are actually at work in the universe, cannot have arisen without the knowledge and sympathy and full understanding of the Sustainer and Comprehender of it all. Nor can functions be expected in the creature which transcend the power of the Creator.

All our faculties, sensations, and emotions must therefore be understood, and in a sense possessed, in some transcendental and to us unimaginable form, by the Deity.

I know that it is possible to deny His existence, just as it is possible to deny the existence of an external world or to maintain that reality is limited to our sensations. If the Deity has a sense of humour, as undoubtedly He has, He must be amused at the remarkable philosophising faculty recently developed by the creature, which on this

planet has become most vigorously self-conscious and is in the early stages of progress towards higher things—a philosophising faculty so acute as to lead him to mistrust and throw away information conveyed to him by the very instruments which have enabled him to become what he is; so that, having become keenly alive to the truth that all we are directly aware of is the fruit of our own sensations and consciousness, he proceeds to the grotesque supposition that these sensations and consciousness may be all that really exists, and that the information which for ages our senses have conveyed to us concerning external things may be illusory, not only in form and detail and appearance, but in substantial fact.

He must be pleased, also, with the enterprise of those eager philosophers who are so strenuously impressed with the truth of some ultimate monistic unification, as to be unwilling to concede the multifariousness of existence; who decline to speak of mind and matter, or of body and spirit, or of God and the world, as in any sense separate entities; who stigmatise as dualistic anything which does not manifestly and consciously strain after an ultimate monistic view; and who then, as a climax, on the

strength of a few years' superficial experience on a planet, by the aid of the sense organs which they themselves perceive to be illusory whenever the actual reality of things is in contemplation, proceed to develop the theory that the whole has come into being without direct intelligence and apart from spiritual guidance, that it is managed so well (or so ill) that it is really not managed at all, that no Deity exists, and that it is absurd to postulate the existence of a comprehensive and all-inclusive guiding Mind.

To be able to perceive comprehensively and state fully not only what is, but also what is not, is a wonderful achievement. I do not think that such a power has yet been acquired by any of the sons of men; nor will the semi-educated readers of this country be wise if they pin their faith and build their hopes on the utterances of any man, however eminent, who makes this superhuman claim.

Now, in all charity, it must be admitted that in some passages Professor Haeckel puts himself under the ban implied by the above paragraph, inasmuch as he conducts a sort of free and easy attack on religion, especially on what he conceives to be the

fundamental doctrines of Christianity. But, after all, it can be perceived that his attack, so far as it is really an attack on religion, is evidently inspired by his mistrust and dislike, and to some extent fear, of Ecclesiasticism, especially of the Ultramontane movement in Germany, against which he says Prince Bismarck began a struggle in 1872. It is this kind of semi-political religion that he is really attacking, more than the pure essence of Christianity itself. He regards it as a bigoted system hostile to knowledge—which, if true, would amply justify an attack—and he says on page 118:

"The great struggle between modern science and orthodox Christianity has become more threatening; it has grown more dangerous for science in proportion as Christianity has found support in an increasing mental and political reaction."

This may seem an exaggerated fear; but the following extract from a pastoral address by the Bishop of Newport, which accidentally I saw reported in the *Tablet*, shows that the danger is not wholly imaginary, if unwise opinions are pressed to their logical practical issue:

"If the formulas of modern science contradict

the science of Catholic dogma, it is the former that must be altered, not the latter." [1]

[1] In case it is unfair to wrench a sentence like this from its context, I quote the larger portion of that instructive report in this note:

Extract from "The Tablet," August 27, 1904—An Address by the Bishop of Newport.

"If the Abbé Loisy has followers within the Church, as we are informed he has, it cannot be doubted that the danger for Catholics is by no means imaginary. For Loisy teaches that the dogmatic definitions of the Church (on the Incarnation), although the best that could be given at the time and under the circumstances, are only a most inadequate expression of the real truth, which they represent merely relatively and imperfectly. These definitions, he says, should now be stated afresh, because the traditional formula no longer corresponds to the way in which the mystery is regarded by contemporary thought. In his view, our present knowledge of the universe should suggest to the Church a new examination of the dogma of Creation; our knowledge of history should make her revise her ideas of revelation; and our progress in psychology and moral philosophy should suggest to her to re-state her theology of the Incarnation. Every one can see that there is a grain of truth in this kind of talk. But it is, on the whole, a pestilent and dangerous heresy. If the formulas of modern science contradict the science of Catholic dogma, it is the former that must be altered, not the latter. If modern metaphysics are incompatible with the metaphysical terms and expressions adopted by councils and explained by the Catholic schools, then modern metaphysics must be rejected as erroneous. The Church does not change her Christian philosophy to suit the world's speculations; she teaches the world, by her theological definitions, what true and sound philosophy is. Whilst every effort should be made by Catholic apologists to smooth the way for a genuine understanding of the Church's dogmatic terminology, two things must never be lost sight of: first, that this terminology expresses real objective truth (however inadequate the expression may be to the full meaning, as God sees it, of any given mystery); and, secondly, that such truth is expressed in terms of sound philosophy which will not be given up, and which may be called the Christian philosophy."

Professor Haeckel continues his criticism of Official Christianity in the following vein:

"The so-called 'Peace between Church and State' is never more than a suspension of hostilities. The modern Papacy, true to the despotic principles it has followed for the last sixteen hundred years, is determined to wield sole dominion over the credulous souls of men; it must demand the absolute submission of the cultured State, which, as such, defends the rights of reason and science. True and enduring peace there cannot be until one of the combatants lies powerless on the ground. Either the Church wins, and then farewell to all 'free science and free teaching'—then are our universities no better than gaols, and our colleges become cloistral schools; or else the modern rational State proves victorious—then, in the twentieth century, human culture, freedom, and prosperity will continue their progressive development until they far surpass even the height of the nineteenth century.

"In order to compass these high aims, it is of the first importance that modern science not only shatter the false structures of superstition and sweep their ruins from the path, but that it also erect a new abode for human emotion on the ground it has cleared—a 'palace of reason,' in which, under the influence of our new monistic views, we do reverence to the real trinity of the nineteenth century—the trinity of 'the true, the good, and the beautiful'" (p. 119).

These are the bases of religion, adopted from Goethe, which in Haeckel's view should entirely replace what he calls the Trinity of Kant, viz., God, Freedom, and Immortality—three ideas which he regards as mere superstition, or as so enveloped in superstition as to be worthless.

Occasionally, however, he attacks not solely ecclesiastical Christianity,—in which enterprise he is entirely within his rights,—but he goes further and abuses some of its more primitive forms and to some extent its practical fruits also. For instance:

"Primitive Christianity preached the worthlessness of earthly life, regarding it merely as a preparation for an eternal life beyond. Hence it immediately followed that all we find in the life of a man here below, all that is beautiful in art and science, in public and in private life, is of no real value. The true Christian must avert his eyes from them; he must think only of a worthy preparation for the life beyond. Contempt of nature, aversion to all its inexhaustible charms, rejection of every kind of fine art, are Christian duties; and they are carried out to perfection when a man separates himself from his fellows, chastises his body, and spends all his time in prayers in the cloister or the hermit's cell. . . . A Christian art is a contradiction in terms" (p. 120).

I think it may, without offence, be said that if he means by "primitive Christianity" the teachings of Christ, he is mistaken, and has something to learn as to what those teachings really were. If he means the times of persecution under the Roman Empire, he could hardly expect much concentration on artistic pursuits or much enjoyment of terrestrial existence when it was liable to be violently extinguished at any moment: sufficient that the early Church survived its struggle for existence. But if he is referring to mediæval Christianity of any other than a debased kind, common knowledge concerning mediæval art and architecture sufficiently rebuts the indictment. So much so, that one may almost wonder if by chance he happened to be thinking of Mohammedanism rather than of Christianity.

But he continues, in a more practical and observant vein:

"Christianity has no place for that well-known love of animals, that sympathy with the nearly related and friendly mammals (dogs, horses, cattle, etc.) which is urged in the ethical teaching of many of the older religions, especially Buddhism. (Unfortunately, Descartes gave some support to the

error in teaching that man only has a sensitive soul, not the animal.) Whoever has spent much time in the south of Europe must have often witnessed those frightful sufferings of animals which fill us friends of animals with the deepest sympathy and indignation. And when one expostulates with these brutal 'Christians' on their cruelty, the only answer is, with a laugh: 'But the beasts are not Christians' " (p. 126).

This, if true, and I have heard it from other sources, does constitute a rather serious indictment against the form of practical Christianity understood by the ignorant classes among the Latin races.

To return, however, to the concluding paragraph of the extract quoted above (on page 70) from his page 119:

No one can have any objection to raise against the dignity and worthiness of the three great attributes which excite Professor Haeckel's, as they excited Goethe's, worship and admiration, viz., the three "goddesses," as he calls them: Truth, Goodness, and Beauty; but there is no necessary competition or antagonism between these and the other three great conceptions which aroused the veneration of Kant: God, Freedom, and Immortality; nor does the upholding of the one triad mean the

overthrow of the other: they may be all co-eternal together and co-equal. Nor is either of these triplets inconsistent with some reasonable view of what may be meant by the Christian Trinity. The total possibility of existence is so vast that no simple formula, nor indeed any form of words, however complex, is likely to be able to sum it up and express its essence to the exclusion of all other modes of expression. It is a pity, therefore, that Professor Haeckel should think it necessary to decry one set of ideas in order to support another set. There is room for all in this large universe—room for everything except downright lies and falseness.

Concerning Truth there is no need to speak: it cannot but be the breath of the nostrils of every genuine scientific man; but his ideas of truth should be large enough to take into account possibilities far beyond anything of which he is at present sure, and he should be careful to be undogmatic and docile in regions of which at present he has not the key.

The meaning of Goodness, the whole domain of ethics, and the higher possibilities of sainthood of

which the human spirit has shown itself capable, are at present outside his domain; and if a man of science seeks to dogmatise concerning the emotions and the will, and asserts that he can reduce them to atomic forces and motions because he has learned to recognise the undoubted truth that atomic forces and motions must accompany them and constitute the machinery of their manifestation here and now, he is exhibiting the smallness of his conceptions and gibbeting himself as a laughing-stock to future generations.

The atmosphere and full meaning of Beauty also he can only dimly grasp. If he seeks to explain it in terms of sexual selection, or any other small conception which he has recently been able to form in connection with vital procedure on this planet, he is explaining nothing: he is merely showing how the perception of beauty may operate in certain cases; but the inner nature of beauty and the faculty by which it is perceived are utterly beyond him. He cannot but feel that the unconscious and unobtrusive beauty of field and hedgerow must have originated in obedience to some primal instinct or in fulfilment of some immanent desire, some lofty

need quite other than anything he recognises as human.

And if a poet, witnessing the colours of a sunset, for instance, or the profusion of beauty with which snow mountains seem to fling themselves to the heavens in districts unpeopled and in epochs long before human consciousness awoke upon the earth, —if such a seer feels the revelation weigh upon his spirit with an almost sickening pressure, and is constrained to ascribe this wealth and prodigality of beauty to the joy of the Eternal Being in His own existence, to an anticipation, as it were, of the developments which lie before the universe in which He is at work, and which He is slowly guiding towards an unimaginable perfection,— it behoves the man of science to put his hand upon his mouth, lest, in his efforts to be true, in the absence of knowledge, he find himself uttering, in his ignorance, words of lamentable folly or blasphemy.

Man and Nature

Consider our own position—it is surely worth considering: We are a part of this planet; on one side certainly and distinctly a part of this material

world, a part which has become self-conscious. At first, we were a part which had become alive; a tremendous step that—introducing a number of powers and privileges which previously had been impossible, but that step introduced no responsibility; we were no longer, indeed, urged by mere pressure from behind, we were guided by our instincts and appetites, but we still obeyed the strongest external motive, almost like electromagnetic automata. Now, however, we have become conscious, able to look before and after, to learn consciously from the past, to strive strenuously towards the future; we have acquired a knowledge of good and evil, we can choose the one and reject the other, and are thus burdened with a sense of responsibility for our acts. We still obey the strongest motive, doubtless, but there is something in ourselves which makes it a motive and regulates its strength. We *can* drift like other animals, and often do; but we can also obey our own volition.

I would not deny the rudiments of self-consciousness, and some of what it implies, to certain domestic animals, notably the dog; but domestication

itself is a result of humanity, and undoubtedly the attributes we are discussing are chiefly and almost solely human; they can hardly be detected in wild nature. No other animal can have a full perception of its own individuality and personality as separate from the rest of existence. Such ideas do not occur in the early periods of even human infancy: they are a later growth. Self-consciousness must have become prominent at a certain stage in the evolutionary process.

How it all arose is a legitimate problem for genetic psychology, but to the plain man it is a puzzle; our ancestors invented legends to account for it—legends of apples and serpents and the like; but the fact is there, however it be accounted for. The truth embedded in that old Genesis legend is deep; it is the legend of man's awakening from a merely animal life to consciousness of good and evil, no longer obeying his primal instincts in a state of thoughtlessness and innocency—a state in which deliberate vice was impossible and therefore higher and purposed goodness also impossible,—it was the introduction of a new sense into the world, the sense of conscience, the power of deliberate choice; the

power also of conscious guidance, the management of things and people external to himself, for preconceived ends. Man was beginning to cease to be merely a passenger on the planet, controlled by outside forces; it is as if the reins were then for the first time being placed in his hands; as if he was allowed to begin to steer, to govern his own fate and destiny, and to take over some considerable part of the management of the world.

The process of handing over the reins to us is still going on. The education of the human race is a long process, and we are not yet fit to be fully trusted with the steering gear; but the words of the old serpent were true enough: once open our eyes to the perception and discrimination of good and evil, once become conscious of freedom of choice, and sooner or later, we must inevitably acquire some of the power and responsibility of gods. A fall it might seem, just as a vicious man sometimes seems degraded below the beasts, but in promise and potency, a rise it really was.

The oneness between ourselves and nature is not a thing to be deplored; it is a thing to rejoice at, when properly conceived. It awakens a kind of

religious enthusiasm even in Haeckel, who clearly perceives but a limited aspect of it; yet the perception is vivid enough to cause him, this so-called Atheist, to close his *Confession of Faith* with words such as these:

"Now, at last, it is given to the mightily advancing human mind to have its eyes opened; it is given to it to show that a true knowledge of nature affords full satisfaction and inexhaustible nourishment not only for its searching understanding, but also for its yearning spirit.

"Knowledge of the true, training for the good, pursuit of the beautiful: these are the three great departments of our monism; by the harmonious and consistent cultivation of these we effect at last the truly beatific union of religion and science, so painfully longed after by so many to-day. The True, the Beautiful, and the Good, these are the three august Divine Ones before which we bow the knee in adoration. . . .

"In the hope that free research and free teaching may always continue, I conclude my monistic *Confession of Faith* with the words: 'May God, the Spirit of the Good, the Beautiful, and the True, be with us.' "

This is clearly the utterance of a man to whose type I unconsciously referred in an article written two years ago (*Hibbert Journal*, January, 1903),

from which I now make the following appropriate extract:

Looking at the loom of nature, the feeling not of despair, but of what has been called atheism, one ingredient of atheism, has arisen: atheism never fully realised, and wrongly so called; recently it has been called severe Theism, indeed; for it is joyful sometimes, interested and placid always, exultant at the strange splendour of the spectacle which its intellect has laid bare to contemplation, satisfied with the perfection of the mechanism, content to be a part of the self-generated organism, and endeavouring to think that the feelings of duty, of earnest effort, and of faithful service, which conspicuously persist in spite of all discouragement, are on this view intelligible as well as instinctive, and sure that nothing less than unrepining, unfaltering, unswerving acquiescence is worthy of our dignity as man.

The above *Confession of Faith*, then, is very well; for the man himself very well, indeed, but it is not enough for the race. Other parts of Haeckel's writings show that it is not enough, and that his conception of what he means by Godhead is narrow

and limited to an extent at which instinct, reason, and experience alike rebel. No one can be satisfied with conceptions below the highest which to him are possible: I doubt if it is given to man to think out a clear and consistent system higher and nobler than the real truth. Our highest thoughts are likely to be nearest to reality: they must be stages in the direction of truth, else they could not have come to us and been recognised as highest. So, also, with our longings and aspirations towards ultimate perfection, those desires which we recognise as our noblest and best; surely they must have some correspondence with the facts of existence, else had they been unattainable by us. Reality is not to be surpassed, except locally and temporarily, by the ideals of knowledge and goodness invented by a fraction of itself; and if we could grasp the entire scheme of things, so far from wishing to

> "shatter it to bits and then
> Remould it nearer to the heart's desire,"

we should hail it as better and more satisfying than any of our random imaginings. The universe is in no way limited to our conceptions: it has a reality apart from them; nevertheless, they themselves

constitute a part of it, and can only take a clear and consistent character in so far as they correspond with something true and real. Whatever we can clearly and consistently conceive, that is *ipso facto* in a sense already existent in the universe as a whole; and that, or something better, we shall find to be a dim foreshadowing of a higher reality.

Explanatory Note on Constructive Thought and Optimism

It may be worth while to explain how it is that, to a physicist unsmitten with any taint of solipsism, a well-elaborated scheme which is consistent with already known facts necessarily seems to correspond, or have close affinity, with the truth. It is the result of experience of a mathematical theorem concerning unique distributions. For instance, it can be shown that in an electric field, however complicated, any distribution of potential which satisfies boundary conditions and one or two other essential criteria must be the actual distribution; for it has been rigorously proved that there cannot be two or more distributions which satisfy those conditions, hence if one is arrived at theoretically, or intuitively, or by any means, it must be the correct one; and no further proof is required.

So, also, in connection with analogies and working models: although they must necessarily be

imperfect, so long as they are only analogies, yet the making or imagining of models (not necessarily or usually a material model, but a conceptual model) is a recognised way of arriving at an understanding of recondite and ultra-sensual processes, occurring, say, in the ether or elsewhere. As an addition to evidence derived from such experiments as have been found possible, and as a supplement to the experience out of which, as out of a nucleus, every conception must grow, the mind is set to design and invent a self-coherent scheme which shall imitate as far as possible the results exhibited by nature. By then using this as a working hypothesis, and pressing it to extremes, it can be gradually amended until it shows no sign of discordance or failure anywhere, and even serves as a guide to new and previously unsuspected phenomena. When that stage is reached, it is provisionally accepted and tentatively held as a step in the direction of the truth; though the mind is always kept ready to improve and modify and enlarge it, in accordance with the needs of more thorough investigation and fresh discovery. It was so, for instance, with Maxwell's electromagnetic theory of light; and there are a multitude of other instances.

In the transcendental or ultra-mundane or supersensual region there is the further difficulty to be encountered, that we are not acquainted with anything like all the "boundary conditions," so to speak; we only know our little bit of the boundary, and we may err egregiously in inferring or attempting to infer the remainder. We may even make a

mistake as to the form of function adapted to the case. Nevertheless there is no better clue, and the human mind is impelled to do the best it can with the confessedly imperfect data which it finds at its disposal. The result, therefore, in this region, is no system of definite and certain truth, as in physics, but is either suspense of judgment altogether, or else a tentative scheme or working hypothesis, to be held undogmatically, in an attitude of constant receptiveness for further light, and in full readiness for modification in the direction of the truth.

So far concerning the ascertainment of truth alone, in intangible regions of inquiry. The further hypothesis that such truth when found will be most satisfactory, or, in other words, higher and better than any alternative plan,—the conviction that faith in the exceeding grandeur of reality shall not be confounded,—requires further justification; and its grounds are not so easy to formulate. Perhaps the feeling is merely human and instinctive; but it is existent and customary, I believe, among physicists, possibly among men of science in general, though I cannot speak for all; and it must be based upon familiarity with a mass of experience in which, after long groping and guesswork, the truth has ultimately been discovered, and been recognised as "very good." It is illustrated, for instance, by the words in which Tyndall closes the first edition of his book on Sound, wherein, after explaining Helmholtz's brilliant theory of Corti's organ and the musical mechanism of the ear,—a theory which, amid the difficulties of actual observation, was

necessarily at first saturated with hypothesis, and is not even yet fully verified,—he says:

"Within the ears of men, and without their knowledge or contrivance, this lute of three thousand strings has existed for ages, accepting the music of the outer world, and rendering it fit for reception by the brain. . . . I do not ask you to consider these views as established, but only as probable. They present the phenomena in a connected and intelligible form; and should they be doomed to displacement by a more correct or comprehensive theory, it will assuredly be found that the wonder is not diminished by the substitution of the truth."

CHAPTER VI

MIND AND MATTER

WHAT, then, is the probable essence of truth in Professor Haeckel's philosophy? for it is not to be supposed that the speculations of an eminent man are baseless, or that he has been led to his view of what he conceives to be the truth by some wholly erroneous path; his initiative convictions are to be respected, for they are based on a far wider experience and knowledge of fact than is given to the average man; and for the average man to consider it likely that there is no foundation whatever for the life convictions of a great specialist is as foolish as to suppose it probable that they are certain and infallible, or that they are uncritically to be accepted even in regions beyond those over which his jurisdiction extends.

First as to the "law of substance," by which he sets so much store; the fact which he is really, though indistinctly, trying to emphasise, is what I

have preferred to formulate as "the persistence of the really existent," see page 29; and, with that modification, we can agree with Haeckel, or with what I take to be his inner meaning, to some extent. We may all fairly agree, I think, that whatever really and fundamentally exists must, so far as bare existence is concerned, be independent of time. It may go through many changes, and thus have a history; that is to say, it must have definite time-relations, so far as its changes are concerned; but it can hardly be thought of as either going out of existence or as coming into existence at any given period, though it may completely change its form and accidents; everything basal must have a past and a future of some kind or other, though any special concatenation or arrangement may have a date of origin and of destruction.

A crowd, for instance, is of this fugitive character: it assembles and it disperses; its existence as a crowd is over, but its constituent elements persist; and the same can be said of a planet or a sun. Yet for some "soul" or underlying reality even in these temporary accretions there is permanence of a sort: —Tyndall's "streak of morning cloud," though it

may have "melted into infinite azure," has not thereby become non-existent, although as a visible object it has disappeared from our ken and become a memory only. It is true that it was a mere aggregate or accidental agglomeration—it had developed no self-consciousness; nothing that could be called personality or identity characterised it,—and so no individual persistence is to be expected for it; yet even it—low down in the scale of being as it is—even it has rejoined the general body of aqueous vapour whence, through the incarnating influence of night, it arose. The thing that *is* both *was* and *shall be*, and whatever does not satisfy this condition must be an accidental or fugitive or essentially temporary conglomeration or assemblage, and not one of the fundamental entities of the universe. It is interesting to remember that this was one of the opinions strongly held by the late Professor Tait, who considered that persistence or conservation was the test or criterion of real existence.

The question, How many fundamental entities in this sense there are, and what they are, is a difficult one. Many people, including such opposite thinkers as Tait and Haeckel, would say "matter" and

"energy"; though Haeckel chooses, on his own account, to add that these two are one. Perhaps Professor Ostwald would agree with him there; though to me the meaning is vague. Physical science, pushed to the last resort, would probably reply that, within its sphere of knowledge at the present stage, the fundamental entities are *ether* and *motion;* and that of other things at present it knows next to nothing. If physical science is interrogated as to the probable persistence, *i. e.*, the fundamental existence, of "life" or of "mind," it ought to reply that it does not know; if asked about "personality," or "souls," or "God," — about all of which Professor Haeckel has fully fledged opinions,—it would have to ask for a definition of the terms, and would speak either not at all or with bated breath concerning them.

The possibility that "life" may be a real and basal form of existence, and therefore persistent, is a possibility to be borne in mind. It may at least serve as a clue to investigation, and some day may bear fruit; at present it is no better than a working hypothesis. It is one that on the whole commends itself to me; for I conceive that though we know

of it only as a function of terrestrial matter, yet that it has another aspect too, and I say this because I see it arriving and leaving—animating matter for a time and then quitting it, just as I see dew appearing and disappearing on a plate. Apart from a solid surface, dew cannot exist as such; and to a savage it might seem to spring into and to go out of existence—to be an exudation from the solid, and dependent wholly upon it; but we happen to know more about it; we know that it has a permanent and continuous existence in an imperceptible, intangible, supersensual form, though its visible manifestation in the form of mist or dew is temporary and evanescent. Perhaps it is permissible to trace in that elementary phenomenon some superficial analogy to an incarnation.

The fact concerning life which lies at the root of Professor Haeckel's doctrine about its origin is that living beings have undoubtedly made their appearance on this planet, where at one time they cannot be suspected of having existed. Consequently, that whatever life may be, it is something which can begin to interact with the atoms of terrestrial matter at some period or state of aggregation

or other condition of elaboration,— a condition which may perhaps be rather definite, if only we were aware of what it was. But that undoubted fact is quite consistent with any view as to the nature of "life," and even with any view as to the mode of its terrestrial commencement; there is nothing in that to say that it is a function of matter alone, any more than that the wind is a function of the leaves which dance under its influence; there is nothing even to contradict the notion that it sprang into existence suddenly at a literal word of command. The improbability or absurdity of such a conception as this last, except in the symbolism of poetry, is extreme, and it is unthinkable by any educated person; but its improbability depends upon other considerations than biologic ones, and it is as repugnant to an enlightened theology as to any other science.

The mode in which biological speculation as to the probable development of living out of dead matter, and the general relation of protoplasm to physics and chemistry, can be surmised or provisionally granted, without thereby concurring in any destructive criticism of other facts and experi-

ences, is explained in Chapter X. on "Life," farther on: and there I emphasise my agreement with parts of the speculative contentions of Professor Haeckel on the positive side.

Soul and Body

Let us consider what are the facts scientifically known concerning the interaction between mind and matter. Fundamentally they amount to this: that a complex piece of matter, called the brain, is the organ or instrument of mind and consciousness; that if it be stimulated, mental activity results; that if it be injured or destroyed, no manifestation of mental activity is possible. Moreover, it is assumed, and need not be doubted, that a portion of brain substance is consumed, oxidised let us say, in every act of mentation, using that term in the vaguest and most general sense, and including in it unconscious as well as conscious operations.

Suppose we grant all this, what then? We have granted that brain is the means whereby mind is made manifest on this material plane, it is the instrument through which alone we know it, but we have not granted that mind is *limited* to its material

manifestation; nor can we maintain that without matter the things we call mind, intelligence, consciousness, have no sort of existence. Mind may be incorporate or incarnate in matter, but it may also transcend it; it is through the region of ideas and the intervention of mind that we have become aware of the existence of matter. It is injudicious to discard our primary and fundamental *awareness* for what is, after all, an instinctive inference or interpretation of certain sensations.

The realities underlying those sensations are only known to us by inference, but they have an independent existence: in their inmost nature, they may be quite other than they seem, and they are in no way dependent upon our perception of them. So, also, our actual personality may be something considerably removed from our conception of it based on our present terrestrial consciousness—a form of consciousness suited to, and developed by, our temporary existence here, but not necessarily more than a fraction of our total self.

Take an analogy: the eye is the organ of vision; by it we perceive light. Stimulate the retina in any way, and we are conscious of the sensation of

light; injure or destroy the eye, and vision becomes imperfect or impossible. If eyes did not exist, we should probably know nothing about light, and we might be tempted to say that light did not exist. In a sense, to a blind race, light would not exist, that is to say, there would be no sensation of light, there would be no sight; but the underlying physical cause of that sensation—the ripples in the ether —would be there all the time. And it is these ethereal ripples which a physicist understands by the term "light." It is quite conceivable that a race of blind physicists would be able to devise experimental means whereby they could make experiments on what to us is luminous radiation, just as we now make experiments on electric waves, for which we have no sense organ. It would be absurd for a psychologist to inform them that light did not exist because sight did not. The *term* might have to be reconsidered and redefined; indeed, most likely a polysyllabic term would be employed, as is unfortunately usual when a thing of which the race in general has no intimate knowledge requires nomenclature. But the thing would be there, though its mode of manifestation would be different;

a term like "vision" might still be employed to signify our mode of perceiving and experiencing the agency which now manifests itself to us through our eyes; and plants might grow by the aid of that agency just as they do now.

So, also, brain is truly the organ of mind and consciousness, and to a brainless race these terms, and most other terms, would be meaningless; but no one is at liberty to assert, on the strength of that fact, that the realities underlying our use of those terms have no existence apart from terrestrial brains. Nor can we say with any security that the stuff called "brain" is the only conceivable machinery which they are able to utilise: though it is true that we know of no other. Yet it would seem that such a proposition must be held by a Materialist, or indeed by a Monist, if that term be employed in its narrowest and most unphilosophic sense—a sense which would be better expressed by the term Materialistic-Monist, with a limitation of the term "matter" to the terrestrial chemical elements and their combinations, *i. e.*, to that form of substance to which the human race has grown accustomed—a sense which tends to exclude ethereal and other

generalisations and unknown possibilities such as would occur to a philosophic Monist of the widest kind.

For that it may ultimately be discovered that there is some intimate and necessary connection between a generalised form of matter and some lofty variety of mind is not to be denied; though, also, it cannot be asserted. It has been surmised, for instance, that just as the corpuscles and atoms of matter, in their intricate movements and relations, combine to form the brain-cell of a human being; so the cosmic bodies, the planets and suns and other groupings of the ether, may perhaps combine to form something corresponding, as it were, to the brain-cell of some transcendent Mind. The idea is to be found in Newton. The thing is a mere guess, it is not an impossibility, and it cannot be excluded from a philosophic system by any negative statement based on scientific fact. In some such sense as that, matter and mind may be, for all we know, eternally and necessarily connected; they can be different aspects of some fundamental unity; and a lofty kind of monism can be true, just as a lofty kind of pantheism can be true. But the miserable,

degraded monism and lower pantheism, which limits the term "God" to that part of existence of which we are now aware,—sometimes, indeed, to a fraction only of that,—which limits the term "mind" to that of which we are ourselves conscious, and the term "matter" to the dust of the earth and the other visible bodies, is a system of thought appropriate, perhaps, to a fertile and energetic portion of the nineteenth century, but not likely to survive as a system of perennial truth.

The term "organ" itself should have given pause to any one desirous of promulgating a scheme such as that.

"Organ" is a name popularly given to an instrument of music. Without it, or some other instrument, no material manifestation or display of music is possible; it is an instrument for the incarnation of music—the means whereby it interacts with the material world and throws the air and so our ears into vibration; it is the means whereby we apprehend it. Injure the organ, and the music is imperfect; destroy it, and it ceases to be possible. But is it to be asserted, on the strength of that fact, that the term "music" has no significance apart from its

material manifestation? Have the ideas of Sir Edward Elgar no reality apart from their record on paper and reproduction by an orchestra? It is true that without suitable instruments and a suitable sense organ we should know nothing of music, but it cannot be supposed that its underlying essence would be therefore extinct or non-existent and meaningless. Can there not be in the universe a multitude of things which matter as we know it is incompetent to express? Is it not the complaint of every genius that his material is intractable, that it is difficult to coerce matter as he knows it into the service of mind as he is conscious of it, and that his conceptions transcend his powers of expression?

The connection between soul and body, or, more generally, between spiritual and material, has been illustrated by the connection between the meaning of a sentence and the written or spoken word conveying that meaning. The writing or the speaking may be regarded as an incarnation of the meaning, a mode of stating or exhibiting its essence. As delivered, the sentence must have time relations; it has a beginning, middle, and end; it may be repeated, and the same general meaning may be

expressed in other words; but the intrinsic meaning of the sentence itself need have no time relations, it may be true always, it may exist as an eternal "now," though it may be perceived and expressed by humanity with varying clearness from time to time.

The soul of a thing is its underlying, permanent reality, that which gives it its meaning and confers upon it its attributes. The body is an instrument or mechanism for the manifestation or sensible presentation of what else would be imperceptible. It is useless to ask whether a soul is immortal—a soul is always immortal "where a soul can be discerned": the question to ask concerning any given object is whether it has a soul or meaning or personal underlying reality at all.

Those who think that reality is limited to its terrestrial manifestation doubtless have a philosophy of their own, to which they are entitled and to which at any rate they are welcome; but if they set up to teach others that monism signifies a limitation of mind to the potentialities of matter as at present known; if they teach a pantheism which identifies God with nature in this narrow sense; if

they hold that mind and what they call matter are so intimately connected that no *transcendence* is possible; that, without the cerebral hemispheres, consciousness and intelligence and emotion and love, and all the higher attributes towards which humanity is slowly advancing, would cease to be; that the term "soul" signifies " a sum of plasma-movements in the ganglion cells"; and that the term "God" is limited to the operation of a known evolutionary process, and can be represented as "the infinite sum of all natural forces, the sum of all atomic forces and all ether vibrations," to quote Professor Haeckel (*Confession of Faith*, p. 78); then such philosophers must be content with an audience of uneducated persons, or, if writing as men of science, must hold themselves liable to be opposed by other men of science, who are able, at any rate in their own judgment, to take a wider survey of existence, and to perceive possibilities to which the said narrow and over-definite philosophers were blind.

Life and Guidance

Matter possesses energy in the form of persistent motion, and it is propelled by force; but neither

matter nor energy possesses the power of automatic guidance and control. Energy has no directing power (this has been elaborated by Croll and others: see, for instance, p. 21, and a letter in *Nature*, vol. xliii., p. 434, thirteen years ago, under the heading "Force and Determinism"). Inorganic matter is impelled solely by pressure from behind: it is not influenced by the future, nor does it follow a preconceived course nor seek a predetermined end.

An organism animated by mind is in a totally different case. The intangible influences of hunger, of a call, of perception of something ahead, are then the dominant feature. An intelligent animal which is being pushed is in an ignominious position and resents it; when led, or when voluntarily obeying a call, it is in its rightful attitude.

The essence of mind is design and purpose. There are some who deny that there is any design or purpose in the universe at all: but how can that be maintained when humanity itself possesses these attributes? (*cf.* p. 65). Is it not more reasonable to say that just as we are conscious of the power of guidance in ourselves, so guidance and intelligent control may be an element running through the

universe, and may be incorporated even in material things?

A traveller who has lost his way in a mountain district, coming across a path, may rejoice, saying: "This will guide me home." A Materialist, if he were consistent, would laugh such a traveller to scorn, saying: "What guidance or purpose can there be in a material object? there is no guidance or purpose in the universe; things *are* because they cannot be otherwise, not because of any intention underlying them. How can a path, which is little better than the absence of grass or the wearing down of stones, know where you live or guide you to any desired destination? Moreover, whatever knowledge or purpose the path exhibits must be *in the path*, must be a property of the atoms of which it is composed. To them some fraction of will, of power, of knowledge, and of feeling *may* perhaps be attributed, and from their aggregation something of the same kind may perhaps be deduced. If the traveller can decipher that, he may utilise the material object to his advantage; but if he conceives the path to have been made with any teleological object or intelligent purpose, he is

abandoning himself to superstition, and is as likely to be led by it to the edge of a precipice as anywhere else. Let him follow his superstition at his peril!"

This is not a quotation, of course: but it is a parable.

Matter is the instrument and vehicle of mind; incarnation is the mode by which mind interacts with the present scheme of things, and thereby the element of guidance is supplied; it can, in fact, be embodied in an intelligent arrangement of inert inorganic matter. Even a mountain path exhibits the property of guidance, and has direction; it is an incorporation of intelligence, though itself inert.

Direction is not a function of energy. The energy of sound from an organ is supplied by the blower of the bellows, which may be worked by a mechanical engine; but the melody and harmony, the sequence and co-existence of notes, are determined by the dominating mind of the musician: not necessarily of the executant alone, for the composer's mind may be evoked to some extent even by a pianola. The music may be said to be incarnate in the roll of paper which is ready to be passed

through the instrument. So also can the conception of any artist receive material embodiment in his work, and if a picture or a beautiful building is destroyed it can be made to rise again from its ashes provided the painter or the architect still lives: in other words, his thought can receive a fresh incarnation; and a perception of the beautiful form shall hereafter, in a kindred spirit, arouse similar ideas.

There is thus a truth in Materialism, but it is not a truth readily to be apprehended and formulated. Matter may become imbued with life, and full of vital association: something of the personality of a departed owner seems to cling sometimes about an old garment; its curves and folds can suggest him vividly to our recollection. I would not too blatantly assert that even a doll on which much affection had been lavished was wholly inert and material in the inorganic sense. The tattered colours of a regiment are sometimes thought worthy to be hung in a church. They are a symbol truly, but they may be something more. I have reason to believe that a trace of individuality can cling about terrestrial objects in a vague and almost imperceptible

fashion, but to a degree sufficient to enable those traces to be detected by persons with suitable faculties.

There is a deep truth in Materialism; and it is the foundation of the material parts of worship—sacraments and the like. It is possible to exaggerate their efficacy, but it is also possible to ignore it too completely. The whole universe is metrical,—everything is a question of degree. A property like radio-activity or magnetism, discovered conspicuously in one form of matter, turns out to be possessed by matter of every kind, though to very varying extent.

So it would appear to be with the power possessed by matter to incarnate and display mind.

There are grades of incarnation: the most thorough kind is that illustrated by our bodies; in them we are incarnate, but probably not even in that case is the incarnation complete. It is quite credible that our whole and entire personality is never terrestrially manifest.

There are grades of incarnation. Some of the personality of an Old Master is locked up in a painting; and whoever wilfully destroys a great

picture is guilty of something akin to murder, namely, the premature and violent separation of soul and body. Some of the soul of a musician can be occluded in a piece of manuscript, to be deciphered thereafter by a perceptive mind.

Matter is the vehicle of mind, but it is dominated and transcended by it. A painting is held together by cohesive forces among the atoms of its pigments; and if those forces rebelled or turned repulsive the picture would be disintegrated and destroyed; yet those forces did not make the picture. A cathedral is held together by inorganic forces, and it was built in obedience to them, but they do not explain it. It may owe its existence and design to the thought of some one who never touched a stone, or even of some one who was dead before it was begun. In its symbolism, it represents One who was executed many centuries ago. Death and Time are far from dominant.

Are we so sure that, when we truly attribute a sunset, or the moonlight rippling on a lake, to the chemical and physical action of material forces,—to the vibrations of matter and ether as we know them,— we have exhausted the whole truth of

things? Many a thinker, brooding over the phenomena of nature, has felt that they represent the thoughts of a dominating, unknown Mind partially incarnate in it all.

CHAPTER VII

PROFESSOR HAECKEL'S CONJECTURAL PHILOSOPHY

A Reply to Mr. McCabe

PART of the preceding, so far as it is a criticism of Haeckel, was given by me in the first instance as a Presidential Address to the Members of the Birmingham and Midland Institute; and the greater portion of this Address was printed in the *Hibbert Journal* for January, 1905. Mr. McCabe, the translator of Haeckel, thereupon took up the cudgels on behalf of his chief, and wrote an article in the following July issue, to the pages of which references will be given when quoting. A few observations of mine in reply to this article emphasise one or two points which perhaps previously were not quite clear; and so this reply, from the October number of the *Hibbert Journal*, may be conveniently here reproduced.

I have no fault to find with the tone of Mr. McCabe's criticism of my criticism of Haeckel; and it is satisfactory that one who has proved himself an enthusiastic disciple, as well as a most industrious

and competent translator, should stand up for the honour and credit of a foreign master when he is attacked.

But in admitting the appropriateness and the conciliatory tone of his article, I must not be supposed to agree with its contentions; for although he seeks to show that after all there is but little difference between myself and Haeckel,—and although in a sense that is true as regards the fundamental facts of science, distinguishing the facts themselves from any hypothetical and interpretative gloss,—yet with Haeckel's interpretations and speculative deductions from the facts, especially with the mode of presentation, and the crude and unbalanced attacks on other fields of human activity, my feeling of divergence occasionally becomes intense.

And it is just these superficial, and, as Mr. McCabe now admits, hypothetical, and as they seem to me rather rash, excursions into side issues, which have attracted the attention of the average man, and have succeeded in misleading the ignorant.

If it could be universally recognised that

"it is expressly as a hypothesis that Haeckel formu-

lates his conjecture as to manner of the origin of life" (p. 744);

and if it could be further generally admitted that his authority outside biology is so weak that

"it is mere pettiness to carp at incidental statements on matters on which Haeckel is known to have or to exercise no peculiar authority, or to labour in determining the precise degree of evidence for the monism of the inorganic or the organic world" (p. 748),

I should be quite content, and hope that I may never find it necessary to carp at these things again. Also I entirely agree with Mr. McCabe, though I have some doubt whether Professor Haeckel would equally agree with him, that

"there remain the great questions whether this mechanical evolution of the universe needed intelligent control, and whether the mind of man stands out as imperishable amidst the wreck of worlds. These constitute the serious controversy of our time in the region of cosmic philosophy or science. These are the rocks that will divide the stream of higher scientific thought for long years to come. To many of us it seems that a concentration on these issues is as much to be desired as sympathy and mutual appreciation" (p. 748).

This is excellent; but then it is surely true that

Professor Haeckel has taken great pains to state forcibly and clearly that these great questions cannot by him be regarded as open; in fact, Mr. McCabe himself says:

"Haeckel's position, if expressed at times with some harshness, and not always with perfect consistency, is well enough known. He rejects the idea of intelligent and benevolent guidance, chiefly on the ground of the facts of dysteleology, and he fails to see any evidence for exempting the human mind from the general law of dissolution" (p. 748).

Ultimately, however, he appears to have been driven to a singularly unphilosophic view, of which Mr. McCabe says:

"It is interesting to note that in his latest work Haeckel regards sensation (or unconscious sentience) as an ultimate and irreducible attribute of substance, like matter (or extension) and force (or spirit)" (p. 752).

I call this unphilosophical because—omitting any reference here to the singular parenthetical explanations or paraphrases, for which I suppose Haeckel is not to be held responsible—this is simply abandoning all attempt at explanation; it even closes the door to inquiry, and is equivalent to an attitude

proper to any man in the street, for it virtually says: "Here the thing is anyhow; I cannot explain it." However legitimate and necessary such an attitude may be as an expression of our ignorance, we ought not to use the phrase "ultimate and irreducible," as if no one could ever explain it.

Moreover, if it be true that

"Haeckel does not teach—never did teach—that the spiritual universe is an aspect of the material universe, as his critic makes him say, it is his fundamental and most distinctive idea that both are attributes or aspects of a deeper reality" (p. 745),

in that case there is, indeed, but little difference between us. But no reader of Haeckel's *Riddle* would have anticipated that such a contention could be made by any devout disciple; and I wonder whether Mr. McCabe can adduce any passage adequate to support so estimable a position. Surely it is difficult to maintain it in face of quotations such as these:

"The peculiar phenomenon of consciousness is . . . a physiological problem, and as such must be reduced to the phenomena of physics and chemistry" (p. 65).

"The soul is in my opinion a natural phenomenon. I therefore consider psychology a branch of

natural science—a section of physiology . . . we shall give to the material basis of all psychic activity, without which it is inconceivable, the provisional name of psychoplasm" (p. 32).

Vital Energy

The one and only point on which I think it worth while to express decided dissidence is to be found in the paragraph where Mr. McCabe makes a statement concerning what he calls "vital force,"—a term I do not remember to have ever used in my life. He claims for Haeckel what is represented by the following extracts from his article (pp. 745, 746, 747):

"He does not say that life is 'knocked out of existence' when the material organism decays. He says that the vital energy no longer exists *as such*, but is resolved into the inorganic energies associated with the gases and relics of the decaying body. Thus the matter looks a little different when Sir Oliver comes to 'challenge him to say by what right he gives that answer.' He gives it on this plain right, that *science always finds these inorganic energies reappearing on the dissolution of life*, and has never in a single instance found the slightest reason to suspect (if we make an exception for the moment of psychical research) that the vital force as such has continued to exist."

The italics are mine. A little farther on he continues:

"There is no serious scientific demur to Haeckel's assumption of a monism of the physical world, and his identification of vital force with ordinary physical and chemical forces."

"Sir Oliver seems to admit, indeed, that the vital force is not in its nature distinct from physical force, but holds that it needs 'guidance.' "

"On all sides we hear the echo of Professor Le Conte's words: 'Vital force may now be regarded as so much force withdrawn from the general fund of chemical and physical forces.' "

Very well, then, here is no conflict on a matter of opinion or philosophic speculation, but divergence on a downright question of scientific fact (let it be noted that I do not wish to hold Professor Haeckel responsible for these utterances of his disciple: he must surely know better), and I wish to oppose the fallacy in the strongest terms.

If it were true that vital energy turned into or was anyhow convertible into inorganic energy; if it were true that a dead body had more inorganic energy than a live one; if it were true that these inorganic energies always or ever reappear on the dissolution of life, then undoubtedly *cadit quæstio;*

life would immediately be proved to be a form of energy, and would enter into the scheme of physics. But inasmuch as all this is untrue,—the direct contrary of the truth,—I maintain that life is *not* a form of energy; that it is *not* included in our present physical categories; that its explanation is still to be sought. And I have further stated—though there I do not dogmatise—that it appears to me to belong to a separate order of existence, which interacts with this material frame of things, and, while there, exerts guidance and control on the energy which already here exists (*cf.* p. 21); for, though they alter the quantity of energy no whit, and though they merely utilise available energy like any other machine, live things are able to direct inorganic terrestrial energy along new and special paths, so as to achieve results which without such living agency could not have occurred—*e. g.*, forests, ant-hills, birds' nests, Forth bridge, sonatas, cathedrals.

I have never taught, nor for a moment thought, that "vital force is akin to physical force, but that it needs guidance" (p. 747); the phrase sounds to me nonsense. I perceive, not as a theory, but as a fact, that life is *itself* a guiding principle, a control-

ling agency; *i. e.*, that a live animal or plant can and does guide or influence the elements of inorganic nature. The fact of an organism's possessing life enables it to build up material into many notable forms,—oak, eagle, man,—which material aggregates last until they are abandoned by the guiding principle, when they more or less speedily fall into decay, or become resolved into their elements, until utilised by a fresh incarnation; and hence I say that whatever life is or is not, it is certainly this: it is a guiding and controlling entity which reacts upon our world according to laws so partially known that we have to say they are practically unknown, and therefore appear in some respects mysterious. If it be thought that I mean by this something superstitious, and for ever inexplicable or unintelligible, I have no such meaning. I believe in the ultimate intelligibility of the universe, though our present brains may require considerable improvement before we can grasp the deepest things by their aid; but this matter of "vitality" is probably not hopelessly beyond us; and it does not follow, because we have no theory of life or death now, that we shall be equally ignorant a century hence.

My chief objection to Professor Haeckel's literary work is that he is dogmatic on such points as these, and would have people believe, what doubtless he believes himself, that he already knows the answer to a number of questions in the realms of physical nature and of philosophy. He writes in so forcible and positive and determined a fashion, from the vantage-ground of scientific knowledge, that he exerts an undue influence on the uncultured among his readers, and causes them to fancy that only benighted fools or credulous dupes can really disagree with the historical criticisms, the speculative opinions, and philosophical, or perhaps unphilosophical, conjectures thus powerfully set forth.

CHAPTER VIII

HYPOTHESIS AND ANALOGIES CONCERNING LIFE

THE view concerning Life which I have endeavoured to express is that it is neither matter nor energy, nor even a function of matter or of energy, but is something belonging to a different category; that by some means, at present unknown, it is able to interact with the material world for a time, but that it can also exist in some sense independently; although in that condition of existence it is by no means apprehensible by our senses. It is dependent on matter for its phenomenal appearance—for its manifestation to us here and now, and for all its terrestrial activities; but otherwise I conceive that it is independent, that its essential existence is continuous and permanent, though its interactions with matter are discontinuous and temporary; and I conjecture that it is subject to a law of evolution—that a linear advance is open to it—

whether it be in its phenomenal or in its occult state.

It may be well to indicate what I mean by conceiving of the possibility that life has an existence apart from its material manifestations as we know them at present. It is easy to imagine that such a view is a mere surmise, having no intelligible meaning, and that it is merely an attempt to clutch at human immortality in an emotional and unscientific spirit. To this, however, I in no way plead guilty.

My ideas about life may be quite wrong, but they are as cold-blooded and free from bias as possible; moreover, they apply not to human life alone, but to all life—to that of all animals, and even of plants; and they are held by me as a working hypothesis, the only one which enables me to fit the known facts of ordinary vitality into a thinkable scheme. Without it, I should be met by all the usual puzzles: (1) as to the stage at which existence begins, if it can be thought of as "beginning" at all[1]; (2) as to

[1] I doubt whether *existence* can be "begun" at all, save as the result of a juxtaposition of elements, or of a conveyance of motion. We can put things together, and we can set things in motion,—statics and kinetics,—can we do more? Ether can be strained, matter can be moved: I doubt whether we see more than this happening in the whole material universe.

the nature of individuality, in the midst of diversity of particles, and the determination of form irrespective of variety of food; (3) the extraordinary rapidity of development, which results in the production of a fully endowed individual in the course of some fraction of a century.

With it, I cannot pretend that all these things are thoroughly intelligible, but the lines on which an explanation may be forthcoming seem to be laid down: the notion being that what we see is a temporary apparition or incarnation of a permanent entity or idea.

It is easiest to explain my meaning by aid of analogues,— by the construction, as it were, of "models," just as is the custom in physics whenever a recondite idea has to be grasped before it can be properly formulated and before a theory is complete.

I will take two analogies: one from politics and one from magnetism.

"Parliament," or "the Army," is a body which consists of individual members constantly changing, and its existence is not dependent on their existence: it pre-existed any particular set of them, and

it can survive a dissolution. Even after a complete slaughter, the idea of the army would survive, and another would come into being, to carry on the permanent traditions and life.

Except as an idea in some sentient mind, it could not be said to exist at all. The mere individuals composing it do not make it: without the idea they would be only a disorganised mob. Abstractions like the British Constitution, and other such things, can hardly be said to have any incarnate existence. These exist *only* as ideas.

Parliament exists fundamentally as an idea, and it can be called into existence or re-incarnated again. Whether it is the same Parliament or not after a general election is a question that may be differently answered. It is not identical, it may have different characteristics, but there is certainly a sort of continuity; it is still a British Parliament; for instance, it has not changed its character to that of the French Assembly or the American Congress. It is a permanent entity even when disembodied; it has a past and it has a future; it has a fundamentally continuous existence though there are breaks or dislocations in its conspicuous activity,

and though each incarnation has a separate identity or personality of its own. It is larger and more comprehensive than any individual representation of it; it may be said to have a "subliminal self," of which any septennial period sees but a meagre epitome.

Some of those epitomes are more, some less, worthy; sometimes there appears only a poor deformity or a feeble-minded attempt, sometimes a strong and vigorous embodiment of the root idea.

As to its technical continuity of existence and actual mode of reproduction, I suppose it would be merely fanciful to liken the "Crown" to those germ-cells or nuclei, whose existence continues without break, which serve the purpose of collecting and composing the somatic cells in due season.

Other illustrations of the temporary incarnation of a permanent idea are readily furnished from the domain of art; but, after all, the best analogy to life that I can at present think of is to be found in the subject of magnetism.

At one time, it was possible to say that magnetism could not be produced except by antecedent magnetism; that there was no known way of

generating it spontaneously; yet that, since it undoubtedly occurs in certain rocks of the earth, it must have come into existence somehow, at a date unknown. It could also be said, and it can be said still, that, given an initial magnet, any number of others can be made, without loss to the generating magnet. By influence or induction exerted by proximity on other pieces of steel, the properties of one magnet can be excited in any number of such pieces,—the amount of magnetism thus producible being infinite; that is, being strictly without limit, and not dependent at all on the very finite strength of the original magnet, which indeed continues unabated. It is just as if magnetism were not really manufactured at all, but were a thing called out of some infinite reservoir; as if something were brought into active and prominent existence from a previously dormant state.

And that indeed is the fact. The process of magnetisation, as conducted with a steel magnet on other pieces of previously inert steel, in no case really generates new lines of magnetic force, though it appears to generate them. We now know that the lines which thus spring into corporeal

existence, as it were, are essentially closed curves or loops, which cannot be generated; they can be expanded or enlarged to cover a wide field, and they can be contracted or shrunk up into insignificance, but they cannot be created, they must be pre-existent; they were in the non-magnetised steel all the time, though they were so small and ill-arranged that they had no perceptible effect whatever; they constituted a potentiality for magnetism; they existed as molecular closed curves or loops, which, by the operation called magnetisation, could, some of them, be opened out into loops of finite area and spread out into space, where they are called "lines of force." They then constitute the region called a magnetic field, which remains a seat of so-called "permanent" magnetic activity, until, by lapse of time, excessive heat, or other circumstance, they close up again; and so the magnet, as a magnet, dies. The magnetism itself, however, has not really died; it has a perpetual existence, and a fresh act of magnetisation can recall it, or something indistinguishable from it, into manifest activity again; so that it, or its equivalent, can once more interact with the rest of material energies, and

be dealt with by physicists, or subserve the uses of humanity. Until that time of re-appearance its existence can only be inferred by the thought of the mathematician; it is indeed a matter of theory, not necessarily recognised as true by the practical man.

Our present view is that the act of magnetisation consists in a re-arrangement and co-ordination of previously existing magnetic elements, lying dormant, so to speak, in iron and other magnetic materials; only a very small fraction of the whole number being usually brought into activity at any one time, and not necessarily always the same actual set. Only a small and indiscriminate selection is made from all the molecular loops; and it can be a different group each time, or some elements may be different and some the same, whenever a fresh individual or magnet is brought into being.

All this can be said concerning the old process of magnetisation — the process as it was doubtless familiar to the unknown discoverer of the lodestone, to the ancient users of the mariner's compass, and to Dr. Gilbert of Colchester, the discoverer of the magnetised condition of the earth.

But within the nineteenth century, a fresh process of magnetisation has been discovered, and this new or electrical process is no longer obviously dependent on the existence of antecedent magnetism, but seems at first sight to be a property freshly or spontaneously generated, as it were. The process was discovered as the result of setting electricity in motion. So long as electricity was studied in its condition at rest on charged conductors, as in the old science of electrostatics or frictional electricity, it possessed no magnetic properties whatever, nor did it encroach on the magnetic domain: only vague similarities in the phenomena of attraction and repulsion aroused attention. But directly electricity was set in motion, constituting what is called an electric current, magnetic lines of force instantly sprang into being, without the presence of any steel or iron; and in twenty years they were recognised. These electrically generated lines of force are similar to those previously known, but they need no matter to sustain them. They need matter to display them, but they themselves exist equally well in perfect vacuum.

How did they manage to spring into being? Can

it be said that they, too, had existed previously in some dormant condition in the ether of space? That they, too, were closed loops opened out, and their existence thus displayed, by the electric current?

That is an assertion which might reasonably be made: it is not the only way of regarding the matter, however, and the mode in which a magnetic field originates round the path of a moving charge —being generated during the acceleration-period by a pulse of radiation which travels with the speed of light; being maintained during the steady-motion period by a sort of inertia as if in accordance with the first law of motion; and being destroyed only by a return pulse of re-radiation during a retardation-period when the moving charge is stopped or diverted or reversed,—all this can hardly be fully explained until the intimate nature of an electric charge has been more fully worked out; and the subject now trenches too nearly on the more advanced parts of physics to be useful any longer as an analogue for general readers.

Indeed, it must be recollected that no analogy will bear pressing too far. All that we are con-

cerned to show is that known magnetic behaviour exhibits a very fair analogy to some aspects of that still more mysterious entity which we call "life"; and if any one should assert that all magnetism was pre-existent in some ethereal condition; that it would never go out of essential existence; but that it could be brought into relation with the world of matter by certain acts,—that while there it could operate in a certain way, controlling the motion of bodies, interacting with forms of energy, producing sundry effects for a time, and then disappearing from our ken to the immaterial region whence it came,—he would be saying what no physicist would think it worth while to object to,—what many, indeed, might agree with.

Well, that is the kind of assertion which I want to make, as a working hypothesis, concerning life.

An acorn has in itself the potentiality not of one oak-tree alone, but of a forest of oak-trees, to the thousandth generation, and indeed of oak-trees without end. There is no sort of law of "conservation" here. It is not as if something were passed on from one thing to another. It is not analogous to energy at all; it is analogous to the magnetism

which can be excited by any given magnet; the required energy, in both cases, being extraneously supplied, and only transmuted into the appropriate form by the guiding principle which controls the operation.

We do not at present know how to generate life without the action of antecedent life, though that may be a discovery lying ready for us in the future; but even if we did, it would still be true (as I think) that the life was in some sense pre-existent; that it was not really created *de novo;* that it was brought into actual practical every-day existence doubtless, but that it had pre-existed in some sense too; being called out, as it were, from some great reservoir or storehouse of vitality, to which, when its earthly career is ended, it will return.

Indeed, it cannot in any proper sense be said ever to have left that storehouse, though it has been made to interact with the world for a time; and, if we might so express it, it may be thought of as carrying back with it, into the general reservoir, any individuality, and any experience and training or development, which it can be thought of as having acquired here. Such a statement as this last

cannot be made of magnetism, to which no known law of evolution and progress can be supposed to apply; but of life, of anything subject to continuous evolution or linear progress embodied in the race, of any condition not cyclically determinate and returning into itself, but progressing and advancing—acquiring fresh potentialities, fresh powers, fresh beauties, new characteristics such as perhaps may never in the whole universe have been displayed before—of everything which possesses such powers as these, a statement akin to the above may certainly be made. To all such things, when they reach a high enough stage, the ideas of continued personality, of memory, of persistent individual existence, not only may, but I think must, apply, notwithstanding the admitted return of the individual after each incarnation to the central store from which it was differentiated and individualised.

Even so a villager, picked out as a recruit and sent to the seat of war, may serve his country, may gain experience, acquire a soul and a width of horizon such as he had not dreamed of; and when he returns, after the war is over, may be merged as

before in his native village. But the village is the richer for his presence, and his individuality or personality is not really lost; though to the eye of the world, which has no further need for it, it has practically ceased to be.

CHAPTER IX

WILL AND GUIDANCE

(*Partially read to the Synthetic Society in February, 1903*)

THE influence of the divine on the human, and on the material world, has been variously conceived in different ages, and various forms of difficulty have been at different times felt and suggested; but always some sort of analogy between human action and divine action has had perforce to be drawn, in order to make the latter in the least intelligible to our conception. The latest form of difficulty is peculiarly deep-seated, and is a natural outcome of an age of physical science. It consists in denying the possibility of any guidance or control,—not only on the part of a Deity, but on the part of every one of His creatures. It consists in pressing the laws of physics to what may seem their logical and ultimate conclusion, in applying the conservation of energy without ruth or hesitation,

and so excluding altogether, as some have fancied, the possibility of free-will action, of guidance, of the self-determined action of mind or living things upon matter. The appearance of control has accordingly been considered illusory, and has been replaced by a doctrine of pure mechanism, enveloping living things as well as inorganic nature.

And those who for any reason have felt disinclined or unable to acquiesce in this exclusion of non-mechanical agencies, whether it be by reason of faith and instinct or by reason of direct experience and sensation to the contrary, have thought it necessary of late years to seek to undermine the foundation of physics, and to show that its much-vaunted laws rest upon a hollow basis, that their exactitude is illusory,— that the conservation of energy, for instance, has been too rapid an induction, that there may be ways of eluding many physical laws and of avoiding submission to their sovereign sway.

By this sacrifice it has been thought that the eliminated guidance and control can philosophically be reintroduced.

This, I gather, may have been the chief motive of

a critical examination of the foundations of physics by an American author, J. B. Stallo, in a little book called the *Concepts of Physics*. But the worst of that book was that Judge Stallo was not fully familiar with the teachings of the great physicists; he appears to have collected his information from popular writings, where the doctrines were very imperfectly laid down; so that part of his book is occupied in demolishing constructions of straw, unrecognisable by professed physicists except as caricatures at which they also might be willing to heave an occasional missile.

The armoury pressed into the service of Professor James Ward's not wholly dissimilar attack on physics is of heavy calibre, and his criticism cannot in general be ignored as based upon inadequate acquaintance with the principles under discussion; but still his Gifford lectures raise an antithesis or antagonism between the fundamental laws of mechanics and the possibility of any intervention, whether human or divine.

If this antagonism is substantial it is serious; for natural philosophers will not be willing to concede fundamental inaccuracy or uncertainty about their

recognised and long-established laws of motion, when applied to ordinary matter; nor will they be prepared to tolerate any the least departure from the law of the conservation of energy, when all forms of energy are taken into account. Hence, if guidance and control can be admitted into the scheme by no means short of undermining and refuting those laws, there may be every expectation that the attitude of scientific men will be perennially hostile to the idea of guidance or control, and so to the efficacy of prayer, and to many another practical outcome of religious belief. It becomes, therefore, an important question to consider whether it is true that life or mind is incompetent to disarrange or interfere with matter at all, except as itself an automatic part of the machine,—whether, in fact, it is merely an ornamental appendage or phantasmal accessory of the working parts.

Now experience—the same kind of experience as gave us our scheme of mechanics—shows us that to all appearance live animals certainly can direct and control mechanical energies to bring about desired and preconceived results; and that man can definitely will that those results shall occur. The way

the energy is provided is understood, and its mode of application is fairly understood; what is not understood is the way its activity is *determined.* Undoubtedly our body is material and can act on other matter; and the energy of its operations is derived from food, like any other self-propelled and fuel-fed mechanism; but mechanism is usually controlled by an attendant. The question is whether our will or mind or life can direct our body's energy along certain channels to attain desired ends, or whether — as in a motor-car with an automaton driver—the end and aim of all activity is wholly determined by mechanical causes. And a further question concerns the mode whereby vital control, if any, is achieved.

Answers that might be hazarded are:

(*a*) That life is itself a latent store of energy, and achieves its results by imparting to matter energy that would not otherwise be in evidence: in which case life would be a part of the machine, and as truly mechanical as all the rest.

Experiment lends no support to this view of the relation between life and energy, and I hold that it is false; because the essential property of energy is

that it can transform itself into other forms, remaining constant in quantity, whereas life does not add to the stock of any known form of energy, nor does death affect the sum of energy in any known way.

(*b*) That life is something outside the scheme of mechanics — outside the categories of matter and energy; though it can nevertheless control or direct material forces—timing them and determining their place of application,—subject always to the laws of energy and all other mechanical laws; supplementing or accompanying these laws, therefore, but contradicting or traversing them no whit.

This second answer I hold to be true; but in order to admit its truth we must recognise that force can be exerted and energy directed by suitable adjustment of existing energy, without any introduction of energy from without; in other words, that the energy of operations automatically going on in any active region of the universe—any region where transformation and transference of energy are continuously occurring, whether life be present or not—can be guided along paths that it would not automatically have taken, and can be directed so as to produce effects that would not otherwise have occurred; and this without any breakage or suspen

sion of the laws of dynamics, and in full correspondence with both the conservation of energy and the conservation of momentum.

That is where I part company with Professor James Ward in the second volume of *Naturalism and Agnosticism;* with whom, nevertheless, on many broad issues I find myself in fair agreement. Those who find a real antinomy between "mechanism and morals" must either throw overboard the possibility of interference or guidance or willed action altogether, which is one alternative, or must assume that the laws of physics are only approximate and untrustworthy, which is the other alternative—the alternative apparently favoured by Professor James Ward. I wish to argue that neither of these alternatives is necessary, and that there is a third or middle course of proverbial safety: all that is necessary is to realise and admit that the laws of physical science are *incomplete*, when regarded as a formulation and philosophical summary of the universe in general. No Laplacian calculator can be supplied with all the data.

In a stagnant and inactive world life would admittedly be powerless: it could only make dry bones

stir in such a world if itself were a form of energy; I do not suppose for a moment that it could be incarnated in such a world; it is only potent where inorganic energy is mechanically "available" —to use Lord Kelvin's term,—that is to say, is either potentially or actually in process of transfer and transformation. In others words, life can generate no trace of energy; it can only guide its transmutations.

It has gradually dawned upon me that the reason why philosophers who are well acquainted with physical or dynamical science are apt to fall into the error of supposing that mental and vital interference with the material world is impossible, in spite of their clamorous experience to the contrary (or else, on the strength of that experience, to conceive that there is something the matter with the formulation of physical and dynamical laws), is because all such interference is naturally and necessarily excluded from scientific methods and treatises.

In pure mechanics, "force" is treated as a function of configuration and momentum: the positions, the velocities, and the accelerations of a conservative system depend solely on each other, on initial

conditions, and on mass; or, if we choose so to express it, the co-ordinates, the momenta, and the kinetic energies of the parts of any dynamical system whatever are all functions of time and of each other, and of nothing else. In other words, we have to deal, in this mode of regarding things, with a definite and completely determinate world, to which prediction may confidently be applied.

But this determinateness is gotten by refusing to contemplate anything outside a certain scheme: it is an internal truth within the assigned boundaries, and is quite consistent with psychical interference and indeterminateness, as soon as those boundaries are ignored; determinateness is not part of the *essence* of dynamical doctrine, it is arrived at by the tacit assumption that no undynamical or hyperdynamical agencies exist: in short, by that process of abstraction which is invariably necessary for simplicity, and indeed for possibility, of methodical human treatment. Every one engaged in scientific research is aware that if exuberant charwomen, or intelligent but mischievous students (who for a moment may be taken to represent life and mind respectively), are admitted into a laboratory and full

scope given to their activities, the scientific results —though still, no doubt, in some strained sense, concordant with law and order—are apt to be too complicated for investigation; wherefore there is usually an endeavour to exclude these incalculable influences, and to make a tacit assumption that they have not been let in.

There is a similar tacit assumption in treatises on physics and chemistry: viz., that the laws of automatic nature shall be allowed unrestricted and unaided play; that nothing shall intervene in any operation from start to finish save mechanical sequent and antecedent; that it is permissible, in fact, to exercise abstraction, as usual, to the exclusion of agents not necessarily connected with the problem, and not contemplated by the equations.

In text-books of dynamics and in treatises of natural philosophy that is a perfectly legitimate procedure[1]; but when, later on, we come to philosophise, and to deal with the universe as a whole, we must forego the ingrained habit of abstraction, and must remember that for a *complete* treatment *nothing*

[1] It is on this basis that there is a science of rigid dynamics, with elasticity and fluidity excluded; and thus also can there be a hydrodynamics in which the consequences of viscosity are ignored.

must permanently be ignored. So if life and mind and will, and curiosity and mischief and folly, and greed and fraud and malice, and a whole catalogue of attributes and things not contemplated in natural philosophy—if these are known to have any real existence in the larger world of total experience, and if there is any reason to believe that any one of them may have had some influence in determining an observed result, then it is foolish to exclude these things from philosophic consideration on the ground that they are out of place in the realm of natural philosophy, that they are not allowed for in its scheme, and therefore cannot possibly be supposed capable of exerting any effective interference, any real guidance or control.

My contention then is—and in this contention I am practically speaking for my brother physicists—that whereas life or mind can neither generate energy nor directly exert force, yet it can cause matter to exert force on matter, and so can exercise guidance and control: it can so prepare any scene of activity, by arranging the position of existing material, and timing the liberation of existing energy, as to produce results concordant with an

idea or scheme or intention: it can, in short, "aim" and "fire."

Guidance of *matter* can be effected by a passive exertion of force without doing work; as a quiescent rail can guide a train to its destination, provided an active engine propels it. But the analogy of the rail must not be pressed: the rail "guides" by exerting force perpendicular to the direction of motion; it does no work but it sustains an equal opposite reaction.[1] The guidance exercised by life or mind is managed in an unknown but certainly different fashion: "determination" can sustain no reaction—if it could it would be a straightforward mechanical agent, but it can utilise the mechanical

[1] It is well to bear in mind the distinction between "force" and "energy." These terms have been so popularly confused that it may be difficult always to discriminate them, but in physics they are absolutely discriminated. We have a direct sense of "force" in our muscles, whether they be moving or at rest. A force in motion is a "power"; it "does work" and transfers energy from one body to another, which is commonly, though incorrectly, spoken of as "generating" energy. But a force at rest—a mere statical stress, like that exerted by a pillar or a watershed—does no work, and "generates" or transfers no energy; yet the one sustains a roof which would otherwise fall, thereby screening a portion of ground from vegetation; while the other deflects a rain-drop into the Danube or the Rhine. This latter is the kind of force which constrains a stone to revolve in a circle instead of a straight line; a force like that of a groove or slot or channel or "guide."

properties both of rail and of engine; it arranged for the rail to be placed in position so that the lateral force thereby exerted should guide all future trains to a desired destination, and it further took steps to design and compose locomotives of sufficient power, and to start them at a prearranged time. It "employs" mechanical stress as a capitalist employs a labourer,—not doing anything itself, but directing the operations. It is impossible to explain all this fully by the laws of mechanics alone, that is to say, no mechanical analysis can be complete and all-embracing, though the whole procedure is fully subject to those laws.

To every force there is an equal opposite force or reaction, and a reaction may be against a live body, but it is never suspected of being against the abstraction, life or mind—that would indeed be enlarging the scope of mechanics!—the reaction is always against some other body. All stresses, as a matter of fact, occur in the ether; and they all have a material terminus at each end (or, in exceptional cases, a wave-front or some other recondite ethereal equivalent); that is to say, something possessing inertia; but the timed or *opportune* existence of a

particular stress may be the result of organisation and control. Mechanical operations can be thus dominated by intelligence and purpose. When a stone is rolling over a cliff, it is all the same to "energy" whether it fall on point A or point B of the beach. But at A it shall merely dent the sand, whereas at B it shall strike a detonator and explode a mine. Scribbling on a piece of paper results in a certain distribution of fluid and production of a modicum of heat: so far as energy is concerned it is the same whether we sign Andrew Carnegie or Alexander Coppersmith, yet the one effort may land us in twelve months' imprisonment or may build a library, according to circumstances, while the other achieves no result at all. John Stuart Mill used to say that our sole power over nature was to *move* things; but, strictly speaking, we cannot do even that: we can only arrange that things shall move each other, and can determine by suitably preconceived plans the kind and direction of the motion that shall ensue at a given time and place, provided always that we include in this category of "things" our undoubtedly material bodies, muscles, and nerves.

But here is just the puzzle: at what point does will or determination enter into the scheme? Contemplate a brain-cell, whence originates a certain nerve-process whereby energy is liberated with some resultant effect; what pulled the detent in that cell which started the impulse? No doubt some chemical process: combination or dissociation, something atomic, occurred; but what made it occur just then and in that way?

I answer, Not anything that we as yet understand, but apparently the same sort of prearrangement that determined whether the stone from the cliff should fall on point A or point B; the same sort of process that guided the pen to make legible and effective writing instead of illegible and ineffective scrawls; the same kind of control that determines when and where a trigger shall be pulled so as to secure the anticipated slaughter of a bird. So far as energy is concerned, the explosion and the trigger-pulling are the same identical operations, whether the aim be exact or random. It is intelligence which directs; it is physical energy which is directed and controlled and produces the result in time and space.

It will be said *some* energy is needed to pull a hair-trigger, to open the throttle-valve of an engine, to press the button which shall shatter a rock. Granted: but the work-concomitants of that energy are all familiar, and equally present whether it be arranged so as to produce any predetermined effect or not. The opening of the throttle-valve, for instance, demands just the same exertion, and results in just the same imperceptible transformation of fully-accounted-for energy, whether it be used to start a train in accordance with a time-table and the guard's whistle, or whether it be pushed over, as if by the wind, at random. The shouting of an order to a troop demands vocal energy and produces its due equivalent of sound; but the intelligibility of the order is something superadded, and its result may be to make not sound or heat alone, but history.

Energy must be *available* for the performance of any physical operation, but the energy is independent of the determination or arrangement. Guidance and control are not forms of energy, nor need they be themselves phantom modes of force: their superposition upon the scheme of physics need per-

turb physical and mechanical *laws* no whit, and yet it may profoundly affect the consequences resulting from those same laws. The whole effort of civilisation would be futile if we could not guide the powers of nature. The powers are there, else we should be helpless; but life and mind are outside those powers, and, by prearranging their field of action, can direct them along an organised course.

And this same life or mind, as we know it, is accessible to petition, to affection, to pity, to a multitude of non-physical influences; and hence, indirectly, the little plot of physical universe which is now our temporary home has become amenable to truly spiritual control.

I lay stress upon a study of the nature and mode of human action of the interfering or guiding kind, because by that study we must be led if we are to form any intelligent conception of divine action. True, it might be feasible to admit divine agency and yet to deny the possibility of any human power of the same kind,—though that would be a nebulous and at least inconclusive procedure; but if once we are constrained to admit the existence and reality

of human guidance and control, superposed upon the physical scheme, we cannot deny the possibility of such power and action to any higher being, or even to any totality of Mind of which ours is a part.

I do not see how the function claimed can be resented, except by those who deny "life" to be anything at all. If it exists, if it is not mere illusion, it appears to me to be something whose full significance lies in another scheme of things, but which touches and interacts with this material universe in a certain way, building its particles into notable configurations for a time—without confounding any physical laws: and then evaporating whence it came. This language is vague and figurative undoubtedly, but, I contend, appropriately so, for we have not yet a theory of life—we have not even a theory of the essential nature of gravitation; discoveries are waiting to be made in this region, and it is absurd to suppose that we are already in possession of all the data. We can wait; but meanwhile we need not pretend that, because we do not understand them, therefore life and will can accomplish nothing; we need not imagine that "life"—with its higher developments and still latent powers

—is an impotent nonentity. The philosophic attitude, surely, is to observe and recognise its effects, both what it can and what it cannot achieve, and to realise that our present knowledge of it is extremely partial and incomplete.

Note on Free Will and Foreknowledge

In the above chapter I must not be understood as pretending to settle the thorny question of a reconciliation between freedom of choice and predetermination or prevision. All I there contend for is that no mechanical or scientific determinism, subject to special conditions in a limited region, can be used to contradict freedom of the will, under generalised conditions, in the universe as a whole.

Nevertheless there are things which may perhaps be usefully said, even on the larger and much-worn topic of the present note. If we still endeavour to learn as much as possible from human analogies, examples are easy:

An architect can draw in detail a building that is to be; the dwellers in a valley can be warned to evacuate their homesteads because a city has determined that a lake shall exist where none existed

before. Doubtless the city is free to change its mind, but it is not expected to; and all predictions are understood to be made subject to the absence of disturbing, *i. e.*, unforeseen, causes. Even the prediction of an eclipse is not free from a remote uncertainty, and in the case of the return of meteoric showers and comets the element of contingency is not even remote.

But it will be said that to higher and superhuman knowledge all possible contingencies would be known and recognised as part of the data. That is quite possibly, though not quite certainly, true: and there comes the real difficulty of reconciling absolute prediction of events with real freedom of the actors in the drama. I anticipate that a complete solution of the problem must involve a treatment of the subject of *time*, and a recognition that "time," as it appears to us, is really part of our human limitations. We all realise that "the past" is in some sense not non-existent but only past; we may readily surmise that "the future" is similarly in some sense existent, only that we have not yet arrived at it; and our links with the future are less understood. That a seer in a moment of clairvoy-

ance may catch a glimpse of futurity—some partial picture of what perhaps exists even now in the forethought of some higher mind—is not inconceivable. It may be, after all, only an unconscious and inspired inference from the present, on an enlarged and exceptional scale; and it is a matter for straightforward investigation whether such prevision ever occurs.

The following article, on the general subject of "Free Will and Determinism," reprinted by permission from the *Contemporary Review* for 1904, may conveniently be here reproduced:

"The conflict between Free Will and Determinism depends on a question of boundaries. We occasionally ignore the fact that there must be a subjective partition in the universe separating the region of which we have some inkling of knowledge from the region of which we have absolutely none; we are apt to regard the portion on our side as if it were the whole, and to debate whether it must or must not be regarded as self-determined. As a matter of fact, any partitioned-off region is in general not completely self-determined, since it is liable to be acted upon by influences from the other side of the partition. If the far side of the boundary is ignored, then an observer on the near side will conclude that things really initiate their own motion and act without stimulation or motive, in some

cases, whereas the fact is that no act is performed without stimulus or motive; even irrational acts are caused by something, and so also are rational acts. Madness and delirium are natural phenomena amenable to law.

"But in actual life we are living on one side of a boundary, and are aware of things on one side only; the things on this side appear to us to constitute the whole universe, since they are all of which we have any knowledge, either through our senses or in other ways. Hence we are subject to certain illusions, and feel certain difficulties: the illusion of unstimulated and unmotived freedom of action, and the difficulty of reconciling this with the felt necessity for general determinism and causation.

"If we speak in terms of the part of the universe that we know and have to do with, we find free agencies rampant among organic life; so that "freedom of action" is a definite and real experience, and for practical convenience is so expressed. But if we could seize the entirety of things and perceive what was occurring beyond the range of our limited conceptions we should realise that the whole was welded together, and that influences were coming through which produced the effects that we observe.

"Those philosophers, if there are any, who assert that we are wholly chained, bound, and controlled by the circumstances of that part of the universe of which we are directly aware—that we are the slaves of our environment and must act as we are compelled by forces emanating from things on our side of the boundary alone,—those philosophers err.

"This kind of determinism is false; and the reaction against it has led other philosophers to assert that we are *lawlessly* free, and able to initiate any action without motive or cause,—that each individual is a capricious and chaotic entity, not part of a cosmos at all!

"It may be doubted whether any one has clearly and actually maintained either of these theses in all its crudity; but there are many who vigorously and cheaply deny one or other of them, and in so denying the one conceive that they are maintaining the other. Both the above theses are false; yet Free Will and Determinism are both true, and in a completely known universe would cease to be contradictories.

"The reconciliation between opposing views lies in realising that the universe of which we have a kind of knowledge is but a portion or an aspect of the whole.

"We are free, and we are controlled. We are free, in so far as our sensible surroundings and immediate environment are concerned; that is, we are free for all practical purposes, and can choose between alternatives as they present themselves. We are controlled, as being intrinsic parts of an entire cosmos suffused with law and order.

"No scheme of science based on knowledge of our environment can confidently predict our actions, nor the actions of any sufficiently intelligent live creature. For "mind" and "will" have their roots on the other side of the partition, and that which we perceive of them is but a fraction of the whole.

Nevertheless, the more developed and consistent and harmonious our character becomes, the less liable is it to random outbreaks, and the more certainly can we be depended on. We thus, even now, can exhibit some approximation to the highest state—that conscious unison with the entire scheme of existence which is identical with perfect freedom.

"If we could grasp the totality of things we should realise that everything was ordered and definite, linked up with everything else in a chain of causation, and that nothing was capricious and uncertain and uncontrolled. The totality of things is, however, and must remain, beyond our grasp; hence the actual working of the process, the nature of the links, the causes which create our determinations, are frequently unknown. And since it is necessary for practical purposes to treat what is utterly beyond our ken as if it were non-existent, it becomes easily possible to fall into the erroneous habit of conceiving the transcendental region to be completely inoperative."

CHAPTER X

FURTHER SPECULATION AS TO THE ORIGIN AND NATURE OF LIFE [1]

Preliminary Remarks on Recent Views in Chemistry

IT is a fact extremely familiar to chemists that the groupings possible to atoms of carbon are exceptionally numerous and complicated, each carbon atom having the power of linking itself with others to an extraordinary extent, so that it is no exceptional thing to find a substance which contains twenty or thirty atoms of carbon as well as other elements linked together in its molecule in a perfectly definite way, the molecule being still classifiable as that of a definite chemical compound. But there are also some non-elementary bodies which, although they are chemically complete and satisfied, retain a considerable vestige of power to

[1] An article reprinted from the *North American Review* for May, 1905.

link their molecules together so as to make a complex and massive compound molecule; and these are able not only to link similar molecules into a more or less indefinite chain, but to unite and include the saturated molecules of many other substances also into the unwieldy aggregate.

Of the non-elementary bodies possessing this property, *water* appears to be one of the chief; for there is evidence to show that the ordinary H_2O molecule of water, although it may be properly spoken of as a saturated or satisfied compound, seldom exists in the simple isolated shape depicted by this formula, but rather that a great number of such simple molecules attach themselves to each other by what is called their residual or outstanding affinity, and build themselves up into a complex aggregate.

The doctrine of residual affinity has been long advocated by Armstrong; and the present writer has recently shown that it is a necessary consequence of the electrical theory of chemical affinity,[1] and that the structure of the resulting groupings, or compound aggregates, may be partially studied

[1] See *Nature*, vol. lxx., p. 176, June 23, 1904.

by means of floating magnets, somewhat after the manner of Alfred Mayer.[1]

It may be well here to explain to students that one of the lines of argument which lead to the conclusion that the water molecule, as it ordinarily exists, is really complex and massive, is based upon measurements of the Faraday dielectric constant for water; for this constant, or "specific inductive capacity," is found to be very large, something like fifty times that of air or free ether; whereas for glass it is only five or six times that of free space. The dielectric constant of a substance generally increases with the density or massiveness of its molecule,—indeed, the value of this constant is one of the methods whereby matter displays its interaction with and loading of the free ether of space,—and any such density as the conventional nine times that of hydrogen for the molecule of water would be wholly unable to explain its immense dielectric constant.

The influence of the massiveness of a water molecule is also displayed in its power of knocking

[1] See an article on "Modern Views of Chemical Affinity," by the present writer in a magazine called *Technics*, for September, 1904.

asunder or dissociating any salts or other simple chemical substance introduced into it; common salt, for instance, is found always to have a certain percentage of its molecules knocked or torn asunder directly it is dissolved in water, so that, in addition to a number of salt molecules in solution, there are a few positively charged sodium atoms and a few negatively charged chlorine atoms, existing in a state of loose attraction to the water aggregate, and amenable to the smallest electric force; which, when applied, urges the chlorine one way and the sodium the other way, so that they can be removed at an electrode and their place supplied by freshly dissociated molecules of salt, thus bringing about its permanent electro-chemical decomposition, and enabling the water to behave as an electrolytic conductor directly a little salt or acid is dissolved in it.

The power of the water molecule to associate itself with molecules of other substances is illustrated by the well-known fact that water is an almost universal solvent. It is its residual affinity which enables it to enter into weak chemical combination with a large number of other substances, and thus to dissolve those substances. The dis-

solving power usually increases when the temperature is raised, possibly because the self-contained or self-sufficient groupings of the water molecules are then to some extent broken up and the fragments enabled to cling to the foreign or introduced matter instead of only to each other. The foreign substance is apt to be extruded again when the liquid cools, and when the affinity of the water-aggregates for each other resumes its sway. Very hot water can dissolve not only the substances familiarly known to be soluble in water, but it can dissolve things like glass also, so that glass vessels are unable to retain water kept under high pressure at a very high temperature, approaching a red heat.

Another material which also seems to have the power of combining with a number of other bodies, under the influence of the loose mode of chemical combination spoken of as residual affinity, is carbon; so that a block of charcoal can absorb hundreds of times its own bulk of certain gases.

Indeed, Sir James Dewar has recently employed this absorbing power of very cold carbon to produce a perfect kind of vacuum, which may, perhaps, be

the nearest approach to absolute vacuum that has yet been attained; probably higher than can be attained by any kind of mechanical or mercury pump.

Unexpected Influence of Size

Suppose now a substance contains a great number of carbon molecules and a great number of water molecules, each of which has this residual affinity or power of clinging together well developed, what may be expected to be the result? Surely, the formation of a molecule consisting of thousands or hundreds of thousands of atoms constituting substances more complex even than those already known to, or analysable by, organic chemistry; and if these complex molecules likewise possess the adhesive faculty, a grouping of millions or even billions of atoms may ultimately be formed. (A billion, that is, a million millions, of atoms is truly an immense number, but the resulting aggregate is still excessively minute. A portion of substance consisting of a billion atoms is only barely visible with the highest power of a microscope; and a speck or granule, in order to be visible to the naked eye, like a grain of lycopodium-dust, must

be a million times bigger still.) Such a grouping is likely to have properties differing not only in degree but in kind from the properties of simple substances.

For it must not be thought that aggregation produces only quantitative change and leaves quality unaltered. Fresh qualities altogether are liable to be introduced or to make their appearance at certain stages—certain critical stages—in the building up of a complex mass (*cf.* p. 62).

The habitability of a house, for instance, depends on its possessing a cavity of a certain size; there is a critical size of brick-aggregate which enables it to serve as a dwelling. Nothing much smaller than this would do at all. The aggregate retains this property, thus conferred upon it by size, however big it may be made after that; until it becomes a palace or a cathedral, when it may perhaps reach an upper limit of size at which it would be crushed by its own weight, or at which the span of roof is too great to be supported. But the difference, as regards habitability, between a palace and a hovel is far less than that between a hovel and one of the air-holes in a brick or loaf, or

any other cavity too small to act as a human habitation. The difference as regards habitability is then an infinite difference.

To take a less trivial instance: a planet which is large enough to retain an atmosphere by its gravitative attraction differs utterly, in potentiality and importance, from the numerous lumps of matter scattered throughout space, which, though they may be as large as a haystack or a mountain, or as the British Isles, or even Europe, are yet too small to hold any trace of air to their surface, and therefore cannot in any intelligible sense of the word be regarded as habitable. One of the lumps of matter in space can become a habitable planet only when it has attained a certain size, which conceivably it might do by falling together with others into a complex aggregate under the influence of gravitative attraction. The asteroids have not succeeded in doing this, but the planets have; and, accordingly, one of them, at any rate, has become a habitable world.

But observe that the great size and the consequent retention of an atmosphere did not generate the inhabitants; it satisfied one of the conditions

necessary for their existence. How they arose is another matter. All that we have seen so far is that an aggregate of bodies may possess properties and powers which the separate bodies themselves possess in no kind or sort of way. It is not a question of degree, but of kind.

So also, further, if the aggregate is large enough, —very much larger than any planet, as large as a million earths aggregated together,—it acquires the property of conspicuous radio-activity, it becomes a self-heating and self-luminous body, able to keep the ether violently agitated in all space round it, and thus to supply the radiation necessary for protecting the habitable worlds from the cold of space to which they are exposed, for maintaining them at a temperature appropriate to organic existence, and likewise for supplying and generating the energy for their myriad activities. It has become, in fact, a central sun and source of heat, solely because of its enormous size combined with the fact of the mutual gravitative attraction of its own constituent particles. No body of moderate size could perform this function, nor act as a perennial furnace to the rest.

Application to Protoplasm

Very well, then, return now to our complex molecular aggregate, and ask what new property, beyond the province of ordinary chemistry and physics, is to be expected of a compound which contains millions or billions of atoms attached to each other in no rigid, stable, frigid manner, but by loose, unstable links, enabling them constantly to re-arrange themselves and to be the theatre of perpetual change, aggregating and re-aggregating in various ways and manifesting ceaseless activities. Such unstable aggregates of matter may, like the water of a pond or a heap of organic refuse, serve as the vehicle for influences wholly novel and unexpected.

Too much agitation—that is, too high a temperature—will split them up and destroy the new-found potentiality of such aggregates; too little agitation — that is, too low a temperature — will permit them to begin to cohere and settle down into frozen, rigid masses insusceptible of manifold activities. But take them just at the right temperature, when sufficiently complex and sufficiently mobile,—take care of them, so to speak, for the

structure may easily be killed,—and what shall we find? We could not exactly guess what would be the result, but we can observe the result as it is.

The result is that the complexes group themselves into minute masses visible in the microscope, each mass being called by us a "cell"; that these cells possess the power of uniting with or assimilating other cells, or fragments of cells, as they drift by and come into contact with them; and that they absorb into their own substance such portions as may be suitable, while the insufficiently elaborated portions—the grains of inorganic or over-simple material—are presently extruded. They thus begin the act of "feeding."

Another remarkable property also can be observed; for a cell which thus grows by feeding need not remain as one individual, but may split into two, or into more than two, which may cohere for a time, but will ultimately separate and continue existence on their own account. Thus begins the act of "reproduction."

But a still more remarkable property can be observed in some of the cells, though not in all: they can not only assimilate a fragment of matter which

comes into contact with them, but they can sense it, apparently, while not yet in contact, and can protrude portions of their substance or move their whole bodies towards the fragment, thus beginning the act of "hunting"; and the incipient locomotory power can be extended till light and air and moisture and many other things can be sought and moved towards, until locomotion becomes so free that it sometimes seems apparently objectless—mere restlessness, change for the sake of change, like that of human beings.

The power of locomotion is liable, however, to introduce the cell to new dangers, and to conditions hostile to its continued aggregate existence. So, in addition to the sense of food and other desirable things ahead, it seems to acquire, at any rate when still further aggregated and more developed, a sense of shrinking from and avoidance of the hostile and the dangerous,—a sense, as it were, of "pain."

And so it enters on its long career of progress, always liable to disintegration or "death"; it begins to differentiate portions of itself for the feeding process, other portions for the reproductive process, other portions, again, for sensory processes, but

retaining the protective sense of pain almost everywhere, until the spots sensitive to ethereal and aërial vibrations—which, arriving as they do from a distance, carry with them so much valuable information, and when duly appreciated render possible perception and prediction as to what is ahead—until these sensitive spots have become developed into the special organs which we now know as the "eye" and the "ear." Then, presently, the power of communication is slowly elaborated: speech and education begin, and the knowledge of the individual is no longer limited to his own experience, but expands till it embraces the past history and the condensed acquisition of the race. And thus gradually arises a developed self-consciousness, a discrimination between the self and the external world, and a realisation of the power of choice and freedom,—a stage beyond which we have not travelled as yet, but a stage at which almost all things seem possible.

The first two properties, assimilation and reproduction, overshadowed by the possibility of *death*, are properties of life of every kind, plant life as of all other. The power of locomotion and special

senses, overshadowed by the sense of *pain*, are the sign of a still further development into what we call "animal life." The further development of mind, consciousness, and sense of freedom, overshadowed by the possibility of wilful error or *sin*, is the conspicuous attribute of life which is distinctively human.

Thus, our complex molecular aggregate has shown itself capable of extraordinary and most interesting processes, has proved capable of constituting the material vehicle of life, the natural basis of living organisms, and even of mind; very much as a planet of certain size proves capable of possessing an atmosphere.

But is it to be supposed that the complex aggregate generated the life and mind, as the planet generated its atmosphere? That is the so-called materialistic view, but to the writer it seems an erroneous one, and it is certainly one that is not proven. It is not even certain that every planet generated all the gases of its own atmosphere: some of them it may have swept up in its excursion through space. What is certain is that it possesses the power of retaining an atmosphere: it is by no

means so certain how all the constituents of that atmosphere arrived.

Questions Concerning the Origin and Nature of Life

All that we have actually experienced and verified is that a complex molecular aggregate is capable of being the vehicle or material basis of life; but to the question *what life is* we have as yet no answer. Many have been the attempts to generate life *de novo*, by packing together suitable materials and keeping them pleasantly warm for a long time; but, where all germs of pre-existing life have rigorously been excluded, the attempt hitherto has been a failure: so far, no life has made its appearance under observation, except from antecedent life.

But, to exclude all trace of antecedent life it is necessary not only to shut out floating germs, but to kill all germs previously existing in the material with which we are dealing. This killing of previous life is usually accomplished by heat; but it has been argued that strong heat will destroy not only the life but the potentiality for life; will break up the complex aggregate on which life depends; will deprive the incubating solution not only of life but of

livelihood. There is some force in the objection, and it is an illustration of the difficulty surrounding the subject. But Tyndall showed that antecedent life could be destroyed without any very high temperature,—by gentle heat periodically applied; heat insufficient to kill the germs, but sufficient to kill the hatched or developed organisms. Periodic heating enables the germs of successive ages to hatch, so to speak, and the product to be slain; and, although some each time may have reproduced germs before slaughter—eggs capable of standing the warmth—yet a succession of such warmings would ultimately be fatal to all, and that without necessarily breaking up the protoplasmic complex aggregates on the existence of which the whole vital potentiality depends.

So far, however, all effort at spontaneous generation has been a failure; possibly because some essential ingredient or condition was omitted, possibly because great lapse of time was necessary. But suppose it was successful; what then? We should then be reproducing in the laboratory a process that must at some past age have occurred on the earth; for at one time the earth was certainly

hot and molten and inorganic, whereas now it swarms with life.

Does that show that the earth generated the life? By no means; no more than it does that the earth necessarily has generated all the gases of its atmosphere, or the meteoric dust which lies upon its snows.

Life may be something not only ultra-terrestrial, but even immaterial, something outside our present categories of matter and energy; as real as they are, but different, and utilising them for its own purpose. What is certain is that life possesses the power of vitalising the complex material aggregates which exist on this planet, and of utilising their energies for a time to display itself amid terrestrial surroundings; and then it seems to disappear or evaporate whence it came. It is perpetually arriving and perpetually disappearing. While it is here, if it is at a sufficiently high level, the animated material body moves about and strives after many objects, some worthy, some unworthy; it acquires thereby a certain individuality, a certain character. It may realise *itself*, moreover, becoming conscious of its own mental and spiritual existence; and it then begins to explore the Mind which, like its

own, it conceives must underlie the material fabric —half displayed, half concealed, by the environment, and intelligible only to a kindred spirit. Thus the scheme of law and order dimly dawns on the nascent soul, and it begins to form clear conceptions of truth, goodness, and beauty; it may achieve something of permanent value, as a work of art or of literature; it may enter regions of emotion and may evolve ideas of the loftiest kind; it may degrade itself below the beasts, or it may soar till it is almost divine.

Is it the material molecular aggregate that has of its own unaided latent power generated this individuality, acquired this character, felt these emotions, evolved these ideas? There are some who try to think that it is. There are others who recognise in this extraordinary development a contact between this material frame of things and a universe higher and other than anything known to our senses; a universe not dominated by physics and chemistry, but utilising the interactions of matter for its own purposes; a universe where the human spirit is more at home than it is among these temporary collocations of atoms; a universe capable of infinite

development, of noble contemplation, and of lofty joy, long after this planet—nay, the whole solar system — shall have fulfilled its present sphere of destiny, and retired cold and lifeless upon its endless way.

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